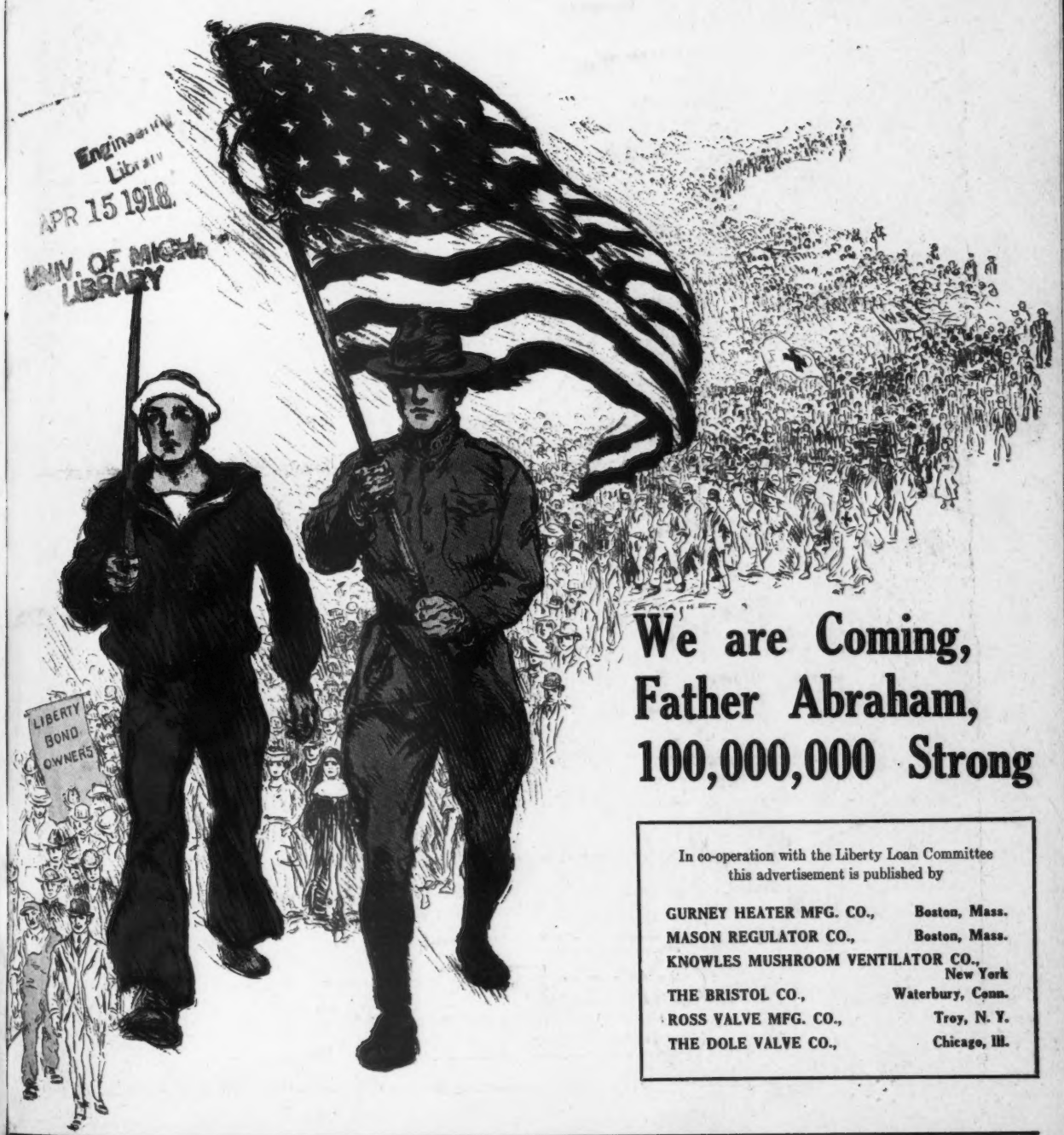
THE HEATING AND VENTILATING MAGAZINE

Vol. XV. No. 4
$1.00 a year. 10 cents a copy

APRIL 1918

Published at Cooperstown, N. Y.
New York Office, 1123 Broadway

Engineering Library
APR 15 1918
UNIV. OF MICH. LIBRARY



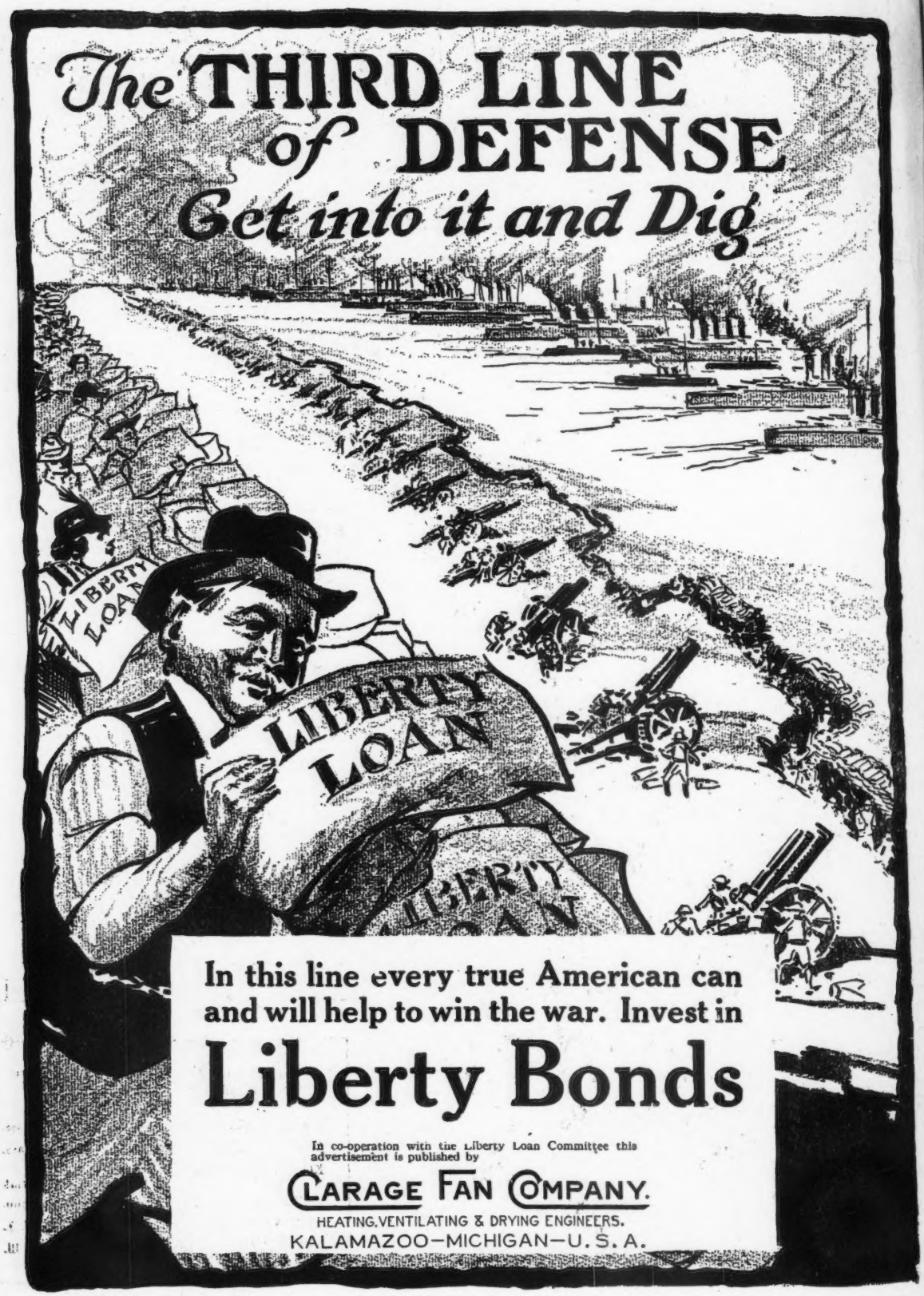
We are Coming, Father Abraham, 100,000,000 Strong

In co-operation with the Liberty Loan Committee this advertisement is published by

GURNEY HEATER MFG. CO.,	Boston, Mass.
MASON REGULATOR CO.,	Boston, Mass.
KNOWLES MUSHROOM VENTILATOR CO.,	New York
THE BRISTOL CO.,	Waterbury, Conn.
ROSS VALVE MFG. CO.,	Troy, N. Y.
THE DOLE VALVE CO.,	Chicago, Ill.

Entered as second-class matter at the Post-Office in Cooperstown, N. Y.

Copyright 1918, by Heating and Ventilating Magazine Co.


The THIRD LINE of DEFENSE
Get into it and Dig
LIBERTY LOAN
LIBERTY LOAN
In this line every true American can and will help to win the war. Invest in
Liberty Bonds
In co-operation with the Liberty Loan Committee this advertisement is published by
CLARAGE FAN COMPANY.
HEATING, VENTILATING & DRYING ENGINEERS.
KALAMAZOO—MICHIGAN—U. S. A.

THE HEATING AND VENTILATING MAGAZINE

Cooperstown, N. Y. APRIL, 1918 1123 Broadway, New York

The Proposed New Jersey-New York Vehicular Tunnel

How the Problem of Ventilation Will Be Solved in the New Highway Under the Hudson River.

When the scheme was first proposed of building a vehicular tunnel between Jersey City and New York it was quickly realized that the advent of motor cars, with their noxious fumes, would make necessary some very radical changes from ordinary tunnel construction. The air in the tunnel would not only become vitiated, but it was easy to see that the exhaust gases from the motors would be positively dangerous to health.

No such conditions existed when the great London tunnels were built and for that reason no arrangements were made for ventilating London's tunnels by mechanical means. Even to-day, although they accommodate many motor vehicles, natural ventilation is depended upon to secure the necessary air renewal. Taking the Rotherhithe Tunnel, London, as an instance, the average traffic between 8 a. m. and 8 p. m. on one typical day included 165 motor

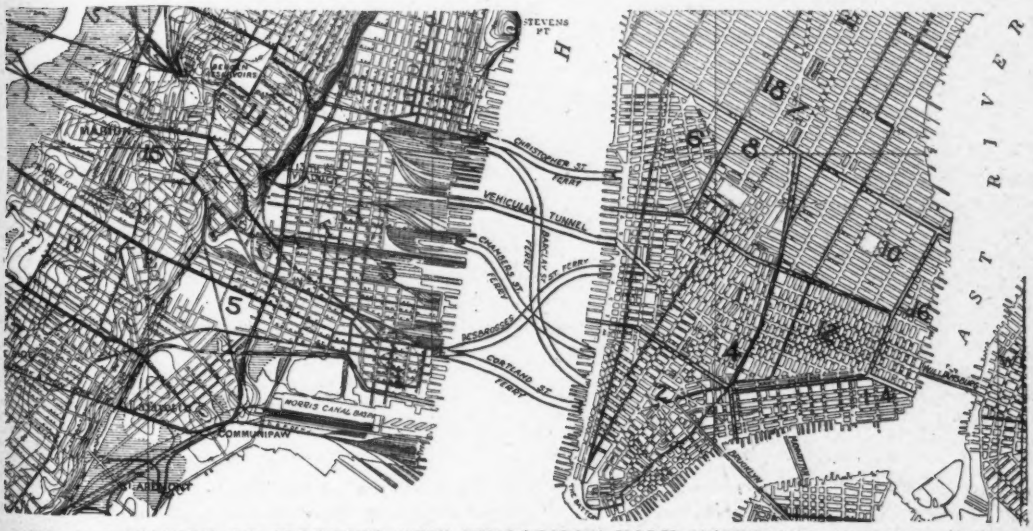


FIG. 1—LOCATION OF PROPOSED NEW JERSEY-NEW YORK VEHICULAR TUNNEL UNDER NORTH RIVER.

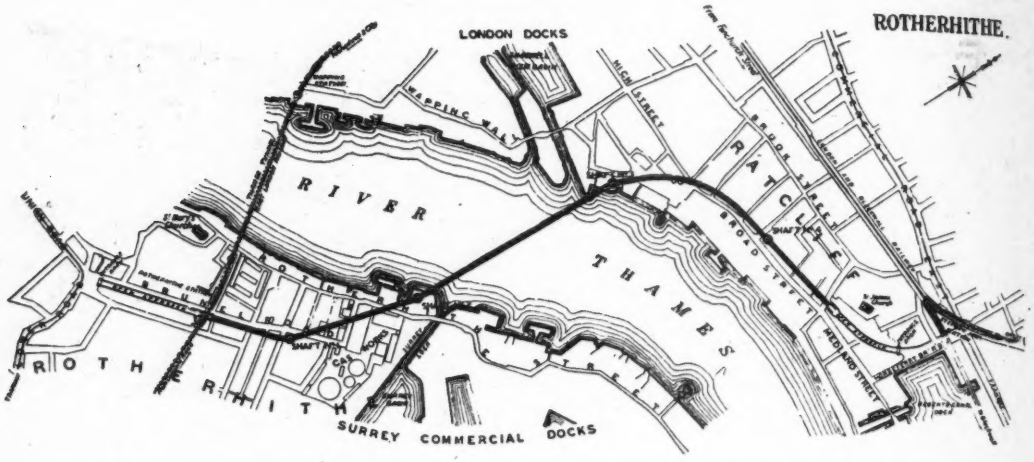


FIG. 2—ROTHERHITE VEHICULAR TUNNEL UNDER THE THAMES, LONDON.

vehicles and on another typical day, 186. Even with this comparatively small motor traffic it was found that the ventilation was distinctly bad and it was quite evident that, with the increase in motor vehicles, artificial ventilation will shortly have to be provided. On certain days the air in the tunnels is reasonably fresh, while on others, with equal traffic, it is very bad, depending upon the direction of the wind, and upon atmospheric conditions.

The land sections between the open ends and the first shafts are short and generally well ventilated, as fresh air enters the open ends and blows out at the first shaft. The inner sections, failing to get fresh air in any quantity from the entrances, depend upon the ventilating shafts to exhaust the bad air, which is then replaced by partially vitiated air from the outer sections. Ordinarily, the air in these sections, while unpleasant to breathe and trying to the eyes, is not so thick that it interferes in any way with traffic, but on days of great humidity the air in the inner sections is so heavy with smoke and vapor that it is impossible to see an approaching vehicle one hundred feet away. Tunnel employes work continuously in this atmosphere with no apparent ill effects.

The fact that there have been no serious prostrations, notwithstanding the passage of as many as 84 motor vehicles per hour through 1,200 ft. of practically unventilated tunnel, indicates that, with proper artificial ventilation, a much larger number of motor vehicles can pass in safety.

In the case of the proposed Hudson River tunnel it is estimated that the motor traffic per day will be not less than 4,249 motors in 1920, 6,870 in 1925 and 10,100 in 1930. It is also necessary to consider that on days when navigation on the river is impeded by fog, ice, or other adverse conditions, all of the motor vehicles in the district now served by the five downtown ferries would seek the tunnel and that, therefore, ventilation and other facilities should be provided for not less than 10,000 motors per day, with the possibility of increasing the facilities so as to provide against double that number.

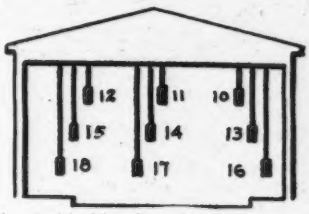
TEST IN EXPERIMENTAL TUNNEL SECTION.

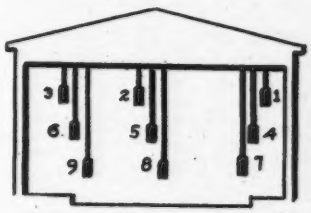
One of the first steps taken, therefore, in the development of the project was to conduct a series of experiments to see whether it was feasible to take care of the fumes arising in the tunnel, especially on account of its great length of about 3,724 ft. between the two pierhead lines. These experiments were made under the auspices of the

Public Service Corporation of New Jersey on its property at Passaic Wharf, in Newark.

An air-tight building was constructed 125 ft. long, as a model of a section of the proposed tunnel, with roadways, sidewalks, etc., complete, including air ducts with openings into the top and bottom of the tunnel, and electrically-operated blowers and exhaust fans of proportionate size.

The tunnel section was filled with gasoline motor trucks and automobiles of various sizes, to the number of eight in all, and a series of tests was made under the direction of Dr. Gellert Alleman, of Swarthmore College. Samples of air taken at many points in the tunnel, with all the cars running,





LOCATION OF PIPETTES IN EXPERIMENTAL TUNNEL SECTION.

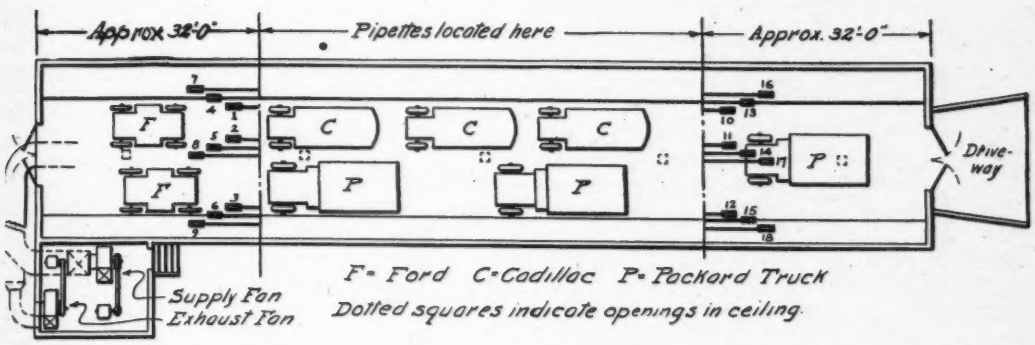


FIG. 3—ARRANGEMENT OF EXPERIMENTAL TUNNEL SECTION IN NEWARK, N. J.

throttled down and racing, with and without ventilation, were analyzed. Tests were made with fresh air introduced at the top and exhausted at the bottom and similar tests with the direction of the air reversed. The volume and velocity of the air so introduced was measured, and a chemical analysis made of the air samples taken during these tests.

The accompanying illustration, Fig. 3 shows the arrangement of the section as tested. The exact conditions of the tests and the results obtained were as follows:

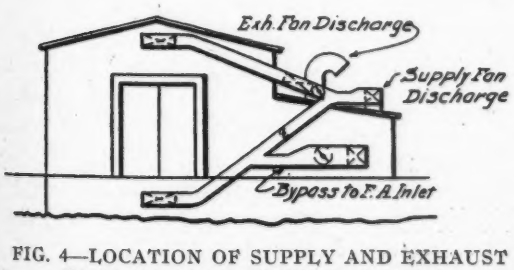


FIG. 4—LOCATION OF SUPPLY AND EXHAUST FANS IN EXPERIMENTAL TUNNEL SECTION.

CONCLUSIONS OF TESTS.

From the analytical results obtained Mr. Alleman draws the following conclusions:

1. When all doors and ventilators are closed and the engines of eight cars are racing for thirty minutes, the atmosphere becomes intolerable; the high content of unsaturated hydro carbons

Test No. 1—All doors and ventilators closed. Engines of eight cars (arranged as in illustration) all racing for 30 min. Average results:

	East End	West End	Tunnel Whole
	%	%	%
Unsaturated hydro carbons	0.15	0.34	0.25
Carbon dioxide	0.42	0.60	0.51
Oxygen	19.22	18.90	19.06
Carbon monoxide	0.59	0.57	0.68

Test No. 2—All doors and ventilators closed. Engines of eight cars all running light for 30 min.:

Unsaturated hydro carbons	0.03	0.01	0.02
Carbon dioxide	0.15	0.11	0.13
Oxygen	19.95	19.48	19.72
Carbon monoxide	0.39	0.47	0.43

Test No. 3—All doors closed and ventilators open. Engines of eight cars all racing for 30 min.:

Unsaturated hydro carbons	0.08	0.04	0.06
Carbon dioxide	0.11	0.12	0.12
Oxygen	20.44	20.28	20.36
Carbon monoxide	0.14	0.16	0.15

Test No. 4—All doors closed and ventilators open. Engines of eight cars all running light for 40 min.:

Unsaturated hydro carbons	*0.01	*0.01	*0.01
Carbon dioxide	0.07	0.04	0.06
Oxygen	20.51	20.57	20.54
Carbon monoxide	0.07	0.08	0.075

*Less.

Test No. 5—Same as Test No. 3, except that the direction of ventilation was reversed, the air entering the experimental tunnel at the top and leaving by the side ventilators on the floor.

Unsaturated hydro carbons	0.10	0.07	0.09
Carbon dioxide	0.16	0.07	0.12
Oxygen	20.50	20.45	20.48
Carbon monoxide	0.26	0.17	0.22

Test No. 6—Same as Test No. 4, except that the direction of ventilation was reversed, the air entering the experimental tunnel at the top and leaving by the side ventilators on the floor:

Unsaturated hydro carbons	0.07	0.03	0.05
Carbon dioxide	0.10	0.08	0.09
Oxygen	20.57	20.50	20.54
Carbon monoxide	0.21	0.18	0.20

("smoke") being responsible for a marked irritation of the eyes and respiratory organs, and the carbon monoxide producing distressing physiological disturbances. Such an atmosphere must be regarded as dangerous to persons who breathe it for a continuous period of fifteen minutes.

2. When all doors and ventilators are closed and the engines of eight cars are "running light" for thirty minutes, there is a marked improvement in the condition of the atmosphere as indicated under Test 2, but the breathing of such an atmosphere for a continuous period of fifteen minutes must also be regarded as dangerous.

3. When all doors are closed and the ventilators are open and exhausting from the top of the tunnel, with the engines of eight cars racing for thirty minutes, there is a further improvement in the condition of the atmosphere over that indicated under Test 1 and Test 2. However, the carbon monoxide content of this atmosphere must be looked upon as probably dangerous either to those persons who are physiologically weak, or to those persons who are particularly susceptible to this gas and who breathe it for a continuous period of thirty minutes.

4. When all doors are closed and the ventilators are open and exhausting from the top of the tunnel, with the engines of eight cars "running light" for forty minutes, the condition of the atmosphere is almost normal and the carbon monoxide content is not dangerous.

This conclusion is further supported by the fact that the eighteen persons who remained in the tunnel during this test, for a continuous period of forty minutes, experienced no unpleasant sensations from breathing this air and no subsequent distress.

5. When all doors are closed and the ventilators are open and exhausting from the bottom of the tunnel, with the engines of eight cars all racing for thirty minutes, the condition of the atmosphere is much worse than in Test 3, where the same conditions prevailed, except that the exhaust was made from the top of the tunnel. Such an atmosphere is not only unpleasant, but must be regarded as dangerous if breathed continuously for a period of thirty minutes.

6. When all doors are closed and the ventilators are open and exhausting from the bottom of the tunnel, with the engines of eight cars all running light for thirty minutes, there is only a slight improvement in the condition of the atmosphere over that indicated in Test 5. Moreover, the condition of this atmosphere is much worse than the air in Test 4, when the same conditions prevailed, except that the exhaust was made from the top of the tunnel. Such an atmosphere is unpleasant and must be regarded as dangerous if breathed continuously for a period of 30 min.

7. It appears that the direction of the exhaust air is of considerable importance, the most satisfactory results being obtained when the air enters the tunnel at the bottom and is withdrawn at the top. This was to be expected because of the fact that the exhaust gases leave the motors at a high temperature and are consequently lighter than air, and rapidly diffuse upward. The lateral propulsion of these heated gases into the atmosphere produces a motion which mixes the exhaust gases with the air, thus accounting for the fairly uniform distribution of the products of combustion in the atmosphere of the various parts of the tunnel.

8. Some of the odors which are unpleasant are in no sense dangerous and are produced by the "cracking" of lubricating oil.

These tests prove that the general method of ventilation outlined for the tunnel is entirely feasible, and that the products of gasoline combustion and smoke can be overcome by the introduction of air in the quantities specified and exhausted as described, leaving the air practically normal. The model tun-

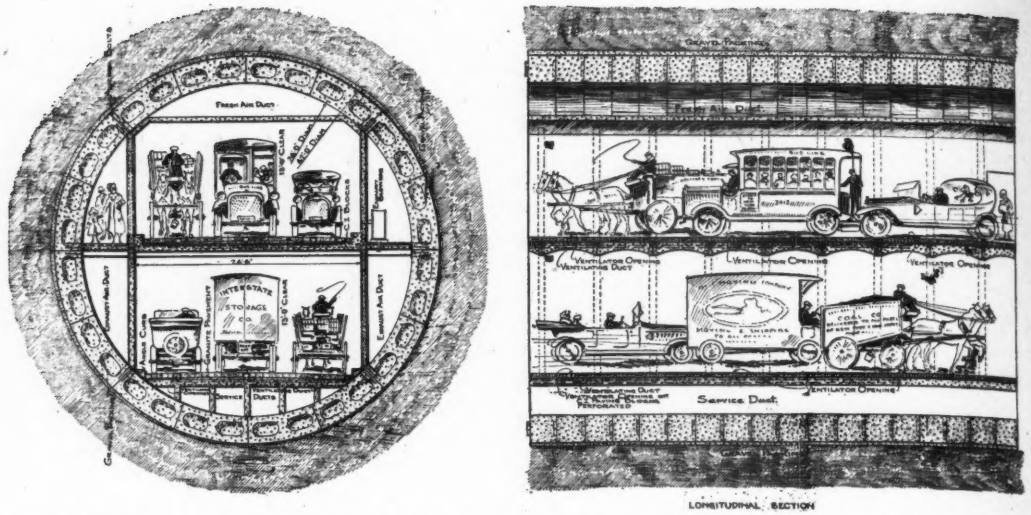


FIG. 5—TUNNEL DESIGNED BY JOHN F. O'ROURKE WHICH HAS BEEN ADOPTED BY THE JOINT BRIDGE AND TUNNEL COMMISSIONS.

nel will be maintained in its present location.

TYPE OF TUNNEL ADOPTED.

Three different types of tunnels have been developed and have been submitted to the commissions representing the two States. The commissions, in turn, submitted the various designs to General George W. Goethals for examination and report.

The design shown in Fig. 5, submitted by John F. O'Rourke, of the O'Rourke Engineering Construction Co., New York, is the one that was recommended for adoption by General Goethals. The joint Bridge and Tunnel Commissions of the two States, at a joint meeting, adopted the report by unanimous vote. The estimated cost of $12,000,000 was also approved. At the present time the State authorities of New York and New Jersey are taking action with a view of authorizing a contract for the immediate commencement of this tunnel, which can be completed in two years.

The O'Rourke design, as will be noted, provides for a tunnel 42 ft. in diameter, to be constructed of concrete blocks, the materials for which can be obtained without difficulty now. Its principal feature, however, is that it is to have two roadways, each of sufficient capacity to accommodate three lines of traffic in each direction.

One of the compelling factors that induced the commissions to adopt the O'Rourke design is the improved method of shield construction that was proposed at the same time by Mr. O'Rourke. This method, it is estimated, will reduce the time of construction to one-fourth of what it would be under the present method, if that were practicable, which is doubtful. This saving is accomplished by having the excavation conducted simultaneously from four levels, while the shield and lining have an air-tight joint between them, thus greatly reducing both the air pressure and the quantity of compressed air required.

The front part of the proposed shield is divided into separate super-imposed air chambers, each chamber projecting beyond the one immediately above it, so that the compressed air may spill out into the ground and rise through the water at the diminishing pressure of the water through which it is ascending. As a result the different air chambers maintain pressures corresponding to that of the water in front of them.

The construction of the shield also

provides means for closing the joint between the tail of the shield and the tunnel lining so that the water cannot enter the tunnel or compressed air escape from it, which avoids the great defect in the present shields. Having the excavation conducted simultaneously on four levels, it reduces the time, as stated, to one-fourth of what it would be if the work were done on one face, as is the present practice. The necessary cover over the shield is also reduced to one-fourth.

VENTILATING SYSTEM TO BE MODIFIED.

The system of ventilation shown in the plan (Fig. 4), in which the exhaust air is drawn out from the two roadways through gratings in the pavement, is only tentative. There is no question that this system would be effective with sufficient capacity provided in the exhaust fans. Subsequent studies of the question, however, show that the method is uneconomical and it is likely that the system that will finally be adopted will force the air from the shafts at the bulkhead lines into the tunnel to the center, at which point effective means will be provided for exhausting the air through large ducts back to the shafts.

It is probable that toward the middle of the tunnel there would be additional intake and exhaust facilities.

Forty-five air changes per hour in the tunnel is the minimum quantity at present under consideration, which, it is estimated, would give an entirely satisfactory diffusion of CO and CO_2. In fact, such a quantity of air, the designers state, would give substantially open-air conditions, with an assumed traffic of three lines of motor trucks every 60 ft. moving 10 miles per hour, and using the worst proportion of gasoline and air for combustion.

It is recommended that ventilation shafts be constructed at the bukheads on each side of the river, where they would offer the least obstruction. The semi-circular arch approach tunnels would be ventilated through specially designed electric light posts, the bottom part of which would consist of cylinders of sufficient diameter to afford the necessary capacity for the intake and exhaust blowers, which would be situated in the arches above the roadways at proper intervals.

EXHAUST OUTLETS AT PAVEMENT LEVEL.

It is contemplated that the intake blowers would discharge the fresh air at the top of the roadways of the tunnel and into the semi-circular spaces where the blowers are situated. The exhaust blowers would be connected to a separate system of ducts under the pavements, each for a given length of roadway, discharging the foul air through the light posts sufficiently above the level of the streets to obviate any nuisance therefrom.

OTHER METHODS PROPOSED FOR CONSTRUCTING TUBE.

It is interesting to note the way the tunnel problem has been approached by other designers, especially with regard to the ventilating provisions. For instance, in a design submitted by the Public Service Corporation of New Jersey, shown in Figs. 6, 7 and 8, a tube was proposed of such a size that two vehicles of the largest dimensions could be placed so as to give them a clearance of 3 ft. 6 in. between them, and an open space of 1 ft. 10½ in. between the wall of the tunnel and the other vehicle on one side and 3 ft. 10½ in. between the other wall of the tunnel and the other vehicle, and a clear space of 12 in. above their tops. This was based on the assumption that the vehicle of the greatest dimensions to use the tunnel will be 8 ft. wide and 12 ft. high.

Fig. 6 shows a cross-section of this design. The dimensions, it will be seen, make a space available for traffic

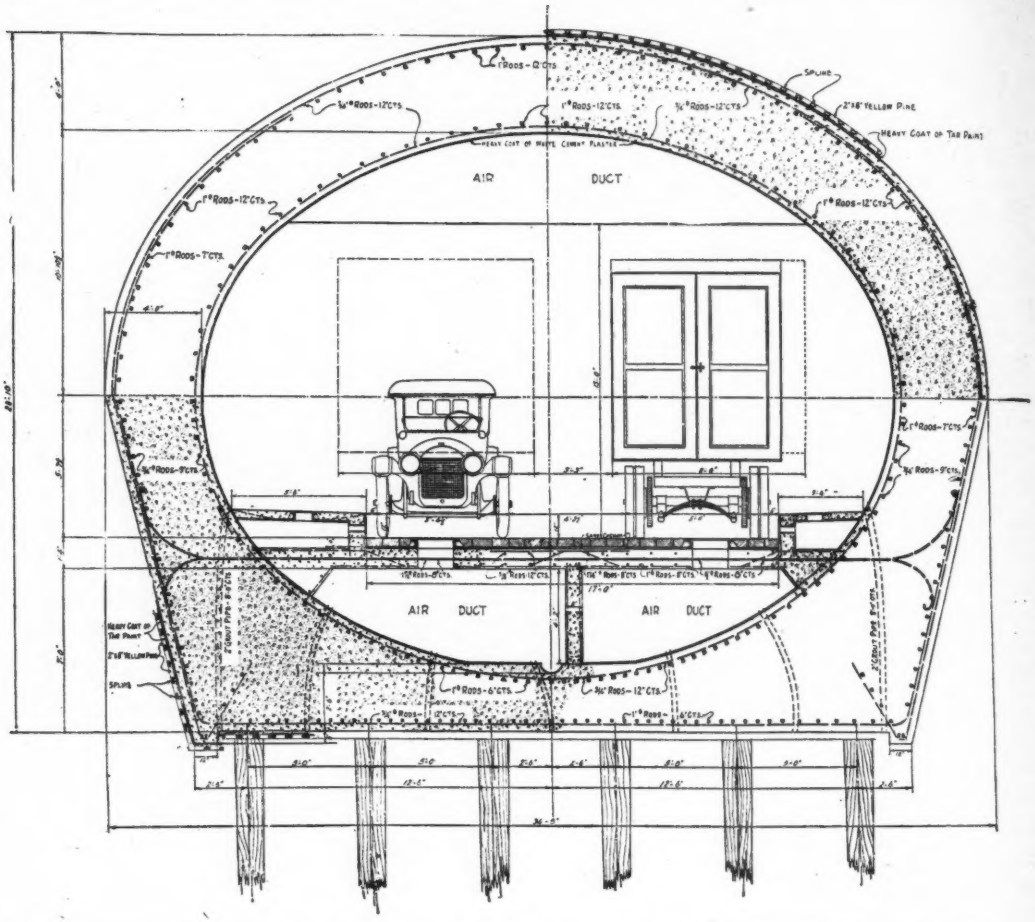


FIG. 6—TUNNEL DESIGN PROPOSED BY PUBLIC SERVICE CORPORATION OF NEW JERSEY.

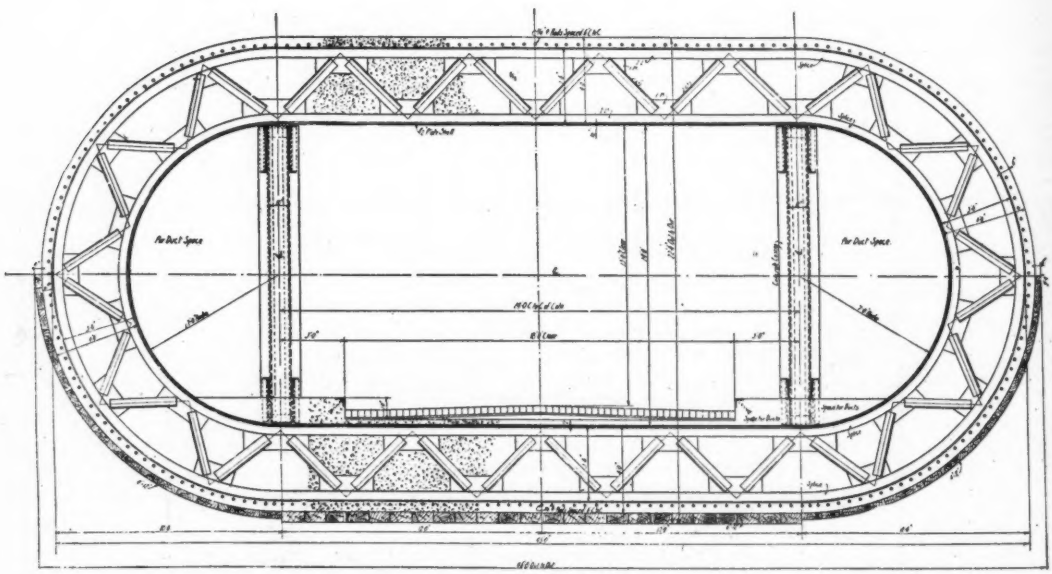


FIG. 7—CONSTRUCTION PROPOSED BY THE PUBLIC SERVICE CORPORATION FOR CLEARING THE BULKHEADS.

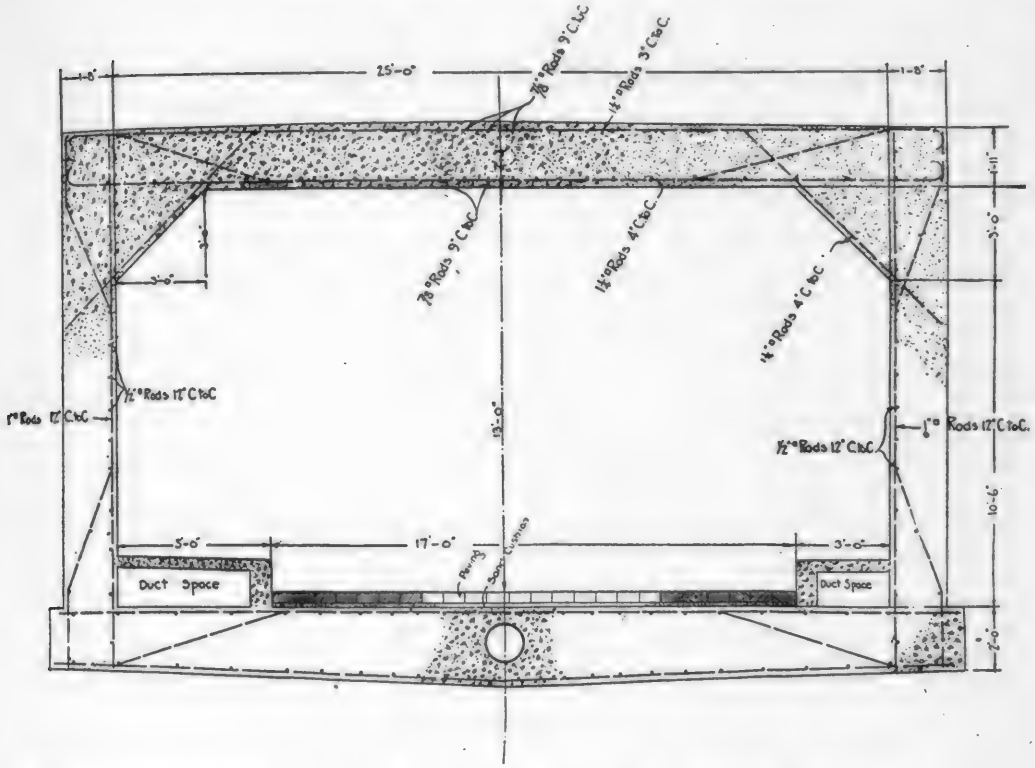


FIG. 8—REINFORCED CONCRETE APPROACH SECTIONS PROPOSED BY THE PUBLIC SERVICE CORPORATION.

in the tunnel 25 ft. wide by 13 ft. high, over all. Figs. 7 and 8 show the special construction proposed for clearing the bulkheads and the reenforced concrete approach sections, respectively.

This tube, it will be noted, was to be built in sections and sunk in the river. This plan was adjudged by General Goethals to be impracticable.

Another form of tunnel was recommended by Messrs. Jacobs and Davies, consisting of two cast-iron lined tunnels, each 33 ft. in diameter. This was not approved for the reason that the cost was prohibitive, apart from any other reasons.

A BIT OF FINANCIAL HISTORY

The credit of the United States was so high and unquestionable that in 1900, two years after the Spanish War, 2 per cent bonds were offered at par and oversubscribed. This is a financial performance no other nation has ever equalled.

United States 4 per cent bonds in 1888 sold as high as 130 and in 1901 brought 139⅞ on the stock market.

The United States has never defaulted on any of its bonds. Not one of its bondholders has ever lost a cent of principal or interest except those who voluntarily have taken losses by selling their bonds in a period of temporary price depression. One hundred cents on the dollar, principal and interest, has the United States always paid.

Back of the $250,000,000,000 to 300,000,000,000 of our national resources stands the rugged honesty of America. Liberty Loan Bonds are the safest security in the world.

CHICAGO COMMISSION ON VENTILATION

Test of Air Conditions in the Wholesale Tailoring Establishment of the John Gorman Company.

EDITED BY JOHN HOWATT

In order to ascertain the air conditions which exist in large work-rooms in buildings having several stories, with windows on less than all four exposures, and for comparison with other work-rooms having different conditions, a test was made in the plant of the John C. Gorman Company, wholesale merchant tailors, in March, 1917.

The work-shop of this company occupies the entire fourth floor of the McNulty Building at 1036 West Van Buren Street, Chicago, Ill. The building is of substantial brick construction and is built on the east and west lot lines, so it has windows only on the north and south sides. The building is approximately 100 ft. wide and 80 ft. deep, and the work room occupies the entire floor area on the fourth floor, with the exception of the space reserved for elevator and stair shafts, the floor being free of all except low partitions.

The different processes of manufacturing men's clothing are conducted on the floor tested. This results in movement of cloth and consequential high dust count in the air.

GAS ARC LAMPS AND STEAM MACHINES ADD TO AIR CONTAMINATION.

The ceiling height is less than 11 ft., and the width of the room is 80 ft. It is, therefore, necessary to use artificial lighting at all times. This is accomplished by means of twenty-three gas arc lamps and numerous incandescent electric lamps. It would be expected, therefore, that the CO_2 percentage in the air and the humidity would be high, due to the gas burned in the arc lamps. In addition to the gas arcs, two steam pressing-machines and fifteen gas-irons are used in pressing clothes, which further increase the CO_2 and the humidity.

NATURAL VENTILATION FOR WORK-ROOMS.

The work-room floor is heated by means of direct steam radiation placed beneath the windows. On the days the tests were conducted, however, all radiator valves were closed, so that as far

McNULTY BUILDING, CHICAGO, IN WHICH THE JOHN GORMAN COMPANY IS LOCATED.

FIG. 2—GENERAL FLOOR ARRANGEMENT, TAILORING ESTABLISHMENT OF THE JOHN GORMAN COMPANY, NORTH END, LOOKING WEST.

as the test purposes are concerned they had no effect upon the result obtained. No mechanical ventilation is provided for the work-room, except the exhaust fan used in exhausting steam and fumes from the hood of the shrinking machine. The supply of fresh air for the entire floor is obtained through the windows.

TESTS CONDUCTED UNDER THREE DIFFERENT WIND CONDITIONS.

A view of the general floor arrangement is shown in Fig. 2. From the description given, it should be very evident that the air movement in the work-room will be dependent to a great extent upon the direction and velocity of the wind and upon the difference in temperature between the air outdoors and inside. A test was, therefore, conducted with the wind blowing, first, against the south windows;—second, parallel with the windows;—and third, against the north windows. The windows were maintained as nearly as possible the same throughout all tests. The air supply and exhaust, the CO_2, the dust particles and relative humidity were obtained by means of the usual instruments.

The quantity of air supplied in any room depending upon the window ventilation is very difficult to obtain by means of anemometers. An effort was made, therefore, to check the air supply by checking against the increase in CO_2. For this purpose the CO_2 in the outside air was considered as being 4 parts in 10,000, and a conversion factor of 0.91 was used in computing the cubic feet of CO_2 gas resulting from the burning of gas furnished at the time of the test by the Peoples Gas, Light & Coke Co.

RESULTS OF TEST NO. 1.

Data sheet No. 1 shows conditions found with the wind blowing from the southwest at a velocity of nine miles per hour. As indicated by the chart, the air movement across the room is quite noticeable. The prevalence of odors is recorded at stations toward the middle of the room and away from the windows on the windward side. This is to be expected. The CO_2 percentage does not build up toward the north side of the room, due to the fact that there is a complete air change through the windows every four minutes. The test shows an extraordinary high bacteria

count at Station No. 20, and offensive odors were noted in this region. At this station eight men were engaged at the time of the test, steaming and pressing clothes with gas irons, accounting for the odor but not necessarily for the high bacteria count.

The results shown on the chart indicate considerable dust in the air. The dust count would be much higher were it not for the rapid air movement across the room toward the lee side of the building.

The effect of using gas in lighting and in pressing clothes is seen in the temperature and humidity readings. Although all radiators were shut off, with an outside temperature of 47° F., and a humidity of 80%, the inside temperature is 73.4° F., and the relative humidity is 56.8%. At this increased temperature, without increasing the humidity from using gas and from steam arising from the clothes pressing process the relative humidity would have been but 31%.

With the exception of Station No. 20, where the clothes pressers are engaged, the air conditions throughout the room under the weather conditions recorded in this test, are very good. Referring to the synthetic air chart (Fig. 3)* the total percentage of perfect in this instance was 76.49 with a dust count of 23,400, bacteria 11.6, odors 88%, CO_2 8.1, and distribution 88.4%. The wet bulb was 63° F. where it should have been 50° under these conditions.

RESULTS OF TEST NO. 2.

Data for Data Sheet No. 2 were obtained with the wind blowing parallel to the face of the windows. The records show clearly the stagnant condition of the air in the room, the air motion being negligible. As a consequence the dust count is very high, due to the lack of air currents to carry away the dust particles formed in the processes of manufacture. On the other hand, the bacteria count averages lower than in Chart No. 1, due principally to an unexplainable smaller bacterial count at Station No. 20. Again the effect of the gas on the temperature and humidity is noted. With all radiators shut off and an outside temperature of 40° F. and a relative humidity of 52%, the inside temperature is 73.2° and the relative humidity is 39.2%, whereas the relative humidity would be 17% were no moisture added to the air in the room. The percentage of perfect ventilation according to the synthetic air chart (Fig. 4) was 75.08.

RESULTS OF TEST NO. 3.

The data for Data Sheet No. 3 were obtained with the wind from the opposite direction to which it was when the data was obtained for Chart No. 1, that is, with the wind striking against the north windows. During this test the greater number of occupants were at the leeward side of the building;—thus, a high bacteria count and CO_2 test would be expected at stations Nos. 1, 2, 3, 4 and 5. The results, however, show no marked increase in CO_2 readings in any part of the room, due to the rapid movement of the air from the north to the south side of the building. The bacteria count is high at nearly every station. The dust count, except at the leeward side of the room is satisfactorily low.

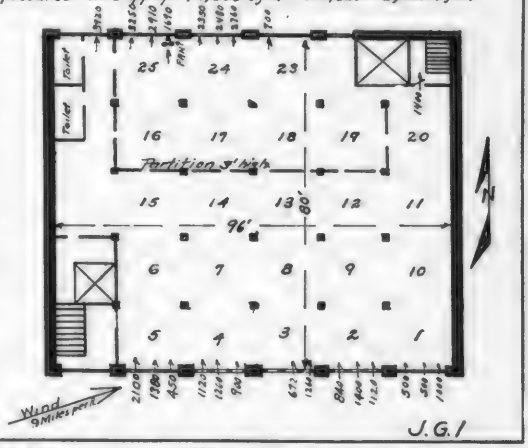
The effect of the gas and pressing process on the room temperature and humidity is again demonstrated. With all radiators shut off and with an outside temperature of 47° F. and a relative humidity of 50%, the inside temperature is 63.4° F. and the relative humidity is 36.5%, whereas it would be 28% were no moisture added to the air in the room. The percentage of perfect ventilation according to the synthetic air chart (Fig. 5) was 81.17 giving the lowest dust count 14,200, the

* For a description of the development of the Synthetic Air Chart see the JOURNAL of The American Society of Heating and Ventilating Engineers for July, 1917; also THE HEATING AND VENTILATING MAGAZINE for March, 1917.

TEST of JOHN C. GORMAN CO'S SHOP - WHOLESALE MERCHANT TAILORS - 4th FLOOR McNULTY BLDG - 103C W. VAN BUREN ST CHICAGO COMMISSION ON VENTILATION

Station	Occupants	Temperature Dry Bulb	Temperature Wet Bulb	Rel Hum %	Dust Particles per cu ft	Bacteria 2 Min Plate	Odors percent Freedom	CO_2
1	10	69	61	64	18000	9	95	6.3
2	9					2		6.0
3	10	73	62	54	25000	19	95	6.6
4	11					6		7.8
5	9	74	63	54½	30000	17	95	8.4
6	4					6		8.4
7	9	74	63	54½	30000	7	90	8.2
8	5					8		7.9
9	7	71	62	61½	22000	9	90	8.8
10	9					4		6.5
11	3	71	62	61	15000	6	90	7.0
12	3					12		6.8
13	3	73	63	58½	33000	5	85	7.8
14	3					14		9.1
15	2	76	65	56	18000	11	85	8.4
16	1					6		8.3
17	0	77	65	52½			85	
18	2					13		7.7
19	0	75	64	55	20000			
20	8	73	62	55		67	70	7.6
23	2					4		10.3
24	0							9.7
25	1	75	64	55		8	90	12.7
Ave	110	73.4	63	56.8	23400	11.6	88	8.1

Time:- 11 AM - 12:30 P.M. Date: Mar. 23-1917
Weather - Gray Temp. = 47° Rel Hum = 80%
Wind - Dir = S.W, Vel. = 9 M.P.H No heat on this floor.
Floor Area = 6700 sq. ft Ceil. = 10'-10" Window space 600
Air Space = 72.000 cu. ft Space per Occupant = 650 cu ft
11 Gas Lamps using 12 cu. ft. gas each = 132 c.f.h. Total
15 Gas Irons using 10 cu. ft. gas each = 150 c.f.h Total
282 c.f.h. gas ⇨ 257 c.f.h CO_2 ⇨ 430 persons
8.1 parts CO_2 with 540 Occupants ⇨ air supply of 13,000 c.f.m.
Measured air Supply = 14,800 c.f.m. Exhaust = 21,400 c.f.m.



DATA SHEET NO. 1, JOHN C. GORMAN COMPANY SHOP, SHOWING CONDITIONS WITH WIND FROM SOUTHWEST.

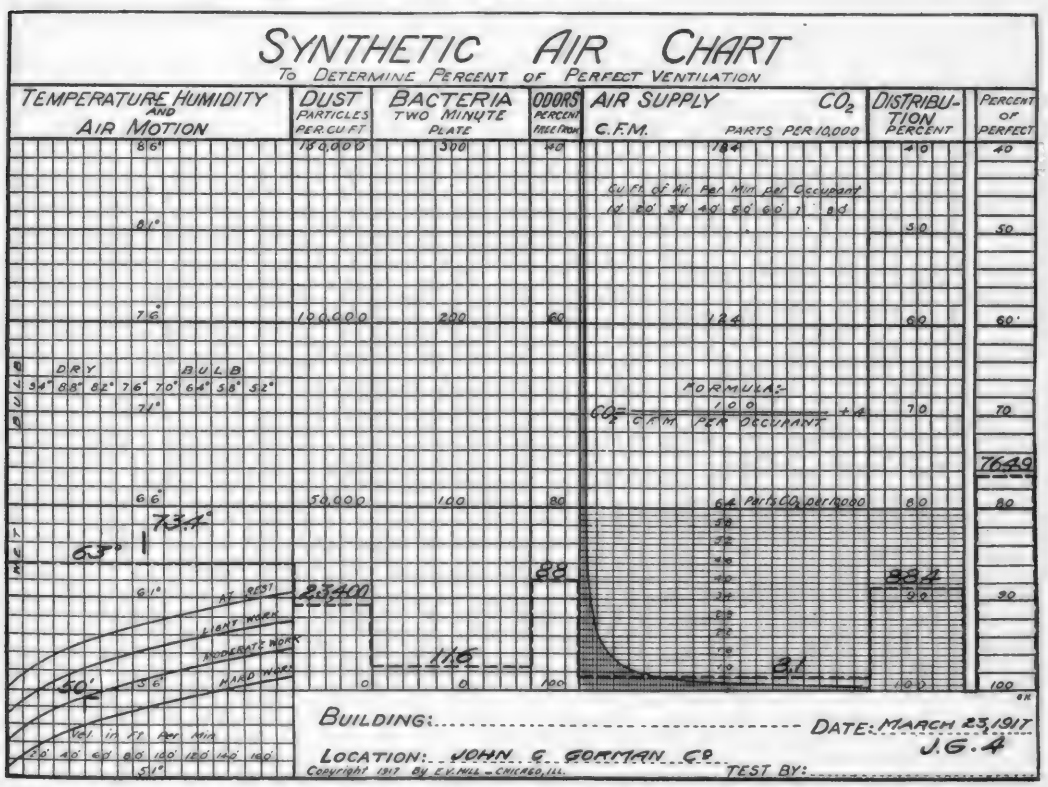


FIG. 3—SYNTHETIC AIR CHART FOR TEST NO. 1.

lowest percentage of odors 90%, and the lowest CO_2 content, 7.9 parts, with practically the same distribution as in test No. 1.

INDOOR CONDITIONS DEPENDENT ON WEATHER OUTSIDE.

The result of these tests demonstrates very clearly how dependent is the air condition inside a building of this type upon outside weather conditions. Constructed as it is with windows on the north and south walls, but with the east and west walls built solid and without any mechanical ventilation, when the wind is in a northerly or southerly direction good air movement is obtained across the entire room from the windward to the leeward side. When the outside temperature is below the freezing point, however, there is objection on the part of the workers in introducing untempered air through the windows, resulting in the windows being kept closed in cold weather and unsatisfactory air conditions in the room.

With an east or west wind striking against the solid brick walls, the air movement through the windows is negligible and the air within the room is very soon far from being in good condition.

The process of manufacture in this room is such that considerable quantities of heat and moisture are given off. This results in a badly overheated and over-humid condition whenever the outside temperature rises. In fact, when the outside temperature was 60° F. the air in the room was oppressively hot and moist. Removal of the gas arcs for lighting and substituting electric lighting for them would help to improve the air somewhat, but it will never be satisfactory under all conditions of outside weather until mechanical means are provided to supplement the present system of ventilation through the windows.

CHICAGO COMMISSION ON VENTILATION — MAY 21, 1917 — ST-2

TEST MADE IN JOHN C GORMAN CO'S SHOP FOR CONSISTENCY OF DUST, CO_2, AND BACTERIA READINGS. FLOOR AREA 6700 SQ. FT, CEILING = 10'-0", VOL. = 72000 CU. FT.

Time	Occupants	Air Space Per Occupant	Temperature		Rel Hum %	Air Motion Ft. Per M.	Dust Particles per cu. Ft.	Bacteria 2 Min. Plate	Odors % Free From	CO_2
			Dry Bulb	Wet Bulb						
10:00 AM.	103		82.5	68.5	49.5		15840	7		6.0
05	"						12000	15		4.7
10	"		82.5	68.5	49.5		12480	10		5.0
15	"						11520	10		4.9
20	"		83.0	68.5	48.0		24000	120		5.0
25	"						9600	8		4.9
30	"		82.5	68.5	48.0		9120	20		4.5
35	"						9600	11		5.7
40	"		83.0	68.0	47.0		10800	21		4.8
45	"						7680	9		6.5
50	"		83.0	68.0	47.0		11520	9		5.1
55	"						8640	11		5.8
AVERAGE	"	700	82.8	68.3	48.2	50	11840	21	95.	5.2

These tests were made in bay No. 18, which is practically the center of room. Four observers were in this bay at all times. Occupants according to bays; - 1=8, 2=8, 3=9, 4=10, 5=9, 6=2, 7=10, 8=5, 9=5, 10=7, 11=3, 12=2, 13=3, 14=3, 15=2, 16=0, 17=0, 18=4, 19=2, 20=7, 22=1, 23=1, 24=1, 25=1, Total=103.

At 10:20 Janitor gathered up scraps and pushed them from East wall thru' bays 12, 13 & 14.

At 10:35 Janitor swept bay 12, at 10:42 he pushed sweepings thru' bay 12, 13 & 14 before bacteria plate was completed. At 10:37 a workman folded cloth within 5 ft. of bateria plate.

In north wall the 2 east windows were closed, all other windows in this wall opened at bottom.

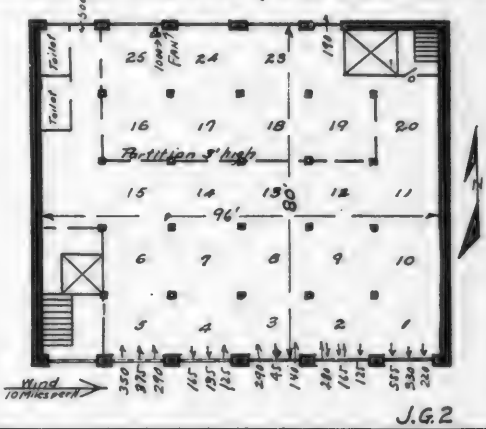
In south wall all window were opened at top.

TEST FOR CONSISTENCY OF DUST, CO_2 AND BACTERIA READINGS.

TEST of JOHN C. GORMAN CO'S SHOP- WHOLESALE MERCHANT TAILORS -4th FLOOR McNULTY BLDG-1036 W. VAN BUREN ST. CHICAGO COMMISSION ON VENTILATION

Station	Occupants	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Dust Particles per cu ft	Bacteria 2 min. Plate	Odors Percent Freedom	CO_2
1	10	72	56	37	55000	6	90	14.5
2	9					5	90	16.9
3	10	74	57	34	45000	11	90	14.0
4	11					12	90	12.2
5	9	75	58	35	72,000	12	90	13.9
6	4						80	12.6
7	9	74	58	38	60000	8	80	14.3
8	5					7	85	13.8
9	7	73	58	40	60000	11	85	14.8
10	9					4	80	13.9
11	3	74	58	38	80,000		75	12.9
12	3					8	80	17.0
13	3	74	58	38	65,000		80	12.1
14	3					8	80	13.9
15	2	74	58	38	50,000	9	75	21.0
16	1					3	90	17.9
17	0	72	57	39			90	24.7
18	2					5	98	16.4
19	0	72	58	41			85	14.3
20	8	73	58	40		7	70	13.3
23	2	72	58	41		1	80	13.3
24	0					6	90	17.6
25	1	72	60	50		3	90	15.8
Ave.	110	73.2		39.2	61,000	7	84	15.3

Time: 10 A.M 12:30 P.M. Date: Mar. 27-1917
Weather:- Clear Temp = 40° Rel. Hum. = 52%
Wind:- Dir. = W., Vel. = 10 M.P.H No heat on this floor
Floor Area = 6700 sq. ft. Ceil. = 10'-10" Window Space = 600 ft
Air Space = 72,000 cu. ft. Space per occupant = 650 cu. ft.
7 Gas Lamps using 12 cu. ft. gas each = 84 c.f.h. Total
15 Gas Irons using 10 cu. ft. gas each = 150 c.f.h. Total
234 c.f.h. gas ≒ 213 c.f. CO_2 ≒ 355 persons
15.3 parts CO_2 with 465 occupants ≒ air supply of 4115 c.f.m.
Measured air Supply = 2320 c.f.m. Exhaust = 3830 c.f.m.



DATA SHEET NO. 2, JOHN C. GORMAN COMPANY SHOP, SHOWING CONDITIONS WITH WIND BLOWING PARALLEL TO FACE OF WINDOWS.

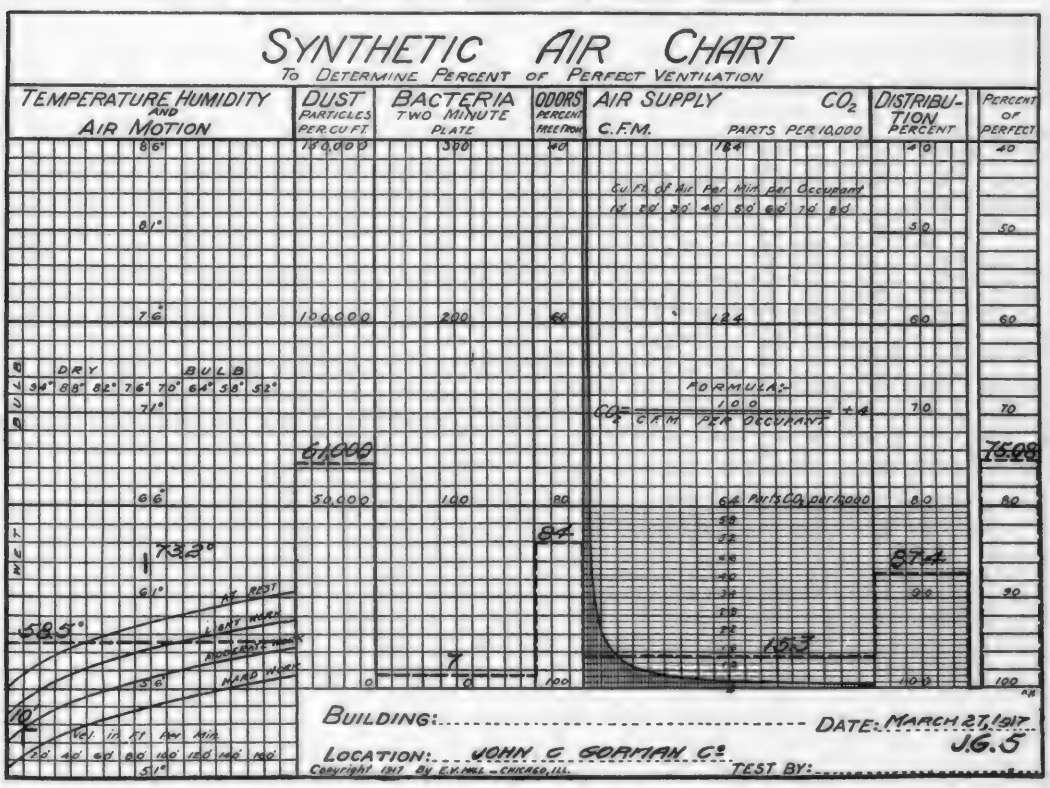


FIG. 4—SYNTHETIC AIR CHART FOR TEST NO. 2.

Discussion.

Data.

Occupants	110
Cubic contents	72,000 cu. ft.
Floor area	6,700 sq. ft.
Window area	600 sq. ft.

Ratio square feet window to cubic feet contents, 1 : 120

Ratio square feet window to floor area, 1 : 11.5.

Cubic feet of space per occupant, 650.

Floor space per occupant, 60.5 sq. ft.

The relation between the window area and the floor area (1 to 11.5, or 8.7%) is very low, being considerably below the minimum ratio of 1 to 8, or 12.5%, required by the State law for unventilated work shops. The insufficiency of window area is further evidenced by the necessity for artificial light at all times. It is particularly unfortunate that the north side of the building should be especially lacking in window area, the necessity for it being greater here than on the south or sunny side.

The ratio of window area to cubic contents is also very low (1 to 120). In this connection the idea presents itself that possibly the prevailing custom of basing window area on the floor space is less logical than would be the expression of the window area as a ratio of the cubic contents of the room, as by the method now in force. A very high room has no more provision for light and for the ingress and egress of air than a very low one, although obviously the amount of space to be illuminated and the amount of air to be moved to secure a complete air change, is greater. Further investigation of this question will be made in the endeavor to establish the proper relation of window area to cubic contents.

A striking example is presented in this building of the necessity of providing air for gas combustion, and for carrying off the products of combustion in addition to that required for ventilation. The large volume of fresh air entering from the windward side, when this side happens to be one on which there are windows, is barely sufficient to care for the needs of the occupants and the gas using appliances. When there is no wind pressure in through the windows, the deficiency of air supply is very marked and results in objectionable and dangerous conditions.

The volume of air delivered per occupant, under favorable and unfavorable wind conditions, was as shown in column A in the following table. The amount per occupant, however, when the equivalent air vitiating capacity of the gas burners is considered, is shown in column B.

	A. C.F.M	B. C.F.M.
March 23,	134	27.4
March 27,	21	5
March 29,	123	29

The character of the work done in this shop is such as to require large volumes of air to carry off the vapors arising from the steaming and pressing of clothes, to supply sufficient oxygen for breathing purposes, and for the combustion of gas in the lamps and irons. The air supply per person which was very low (5 C.F.M.) on March 27 when the outside temperature was 40° F. and there were seventeen windows open, would certainly approach the vanishing point in zero weather when the windows were closed tightly. It follows clearly that, in the drawing-up of requirements or in the design of apparatus for the ventilation of workshops of this character, consideration must be given to the oxygen-consuming effect of the lights and other gas-burning apparatus.

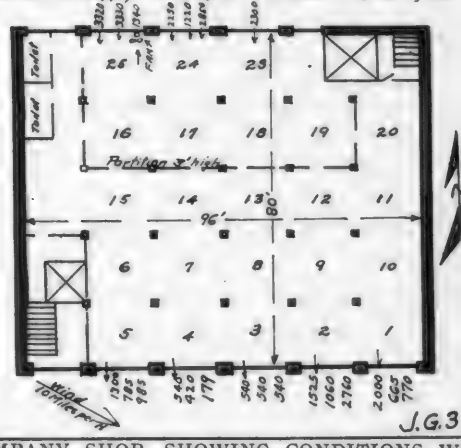
ROOMS VENTILATED BY WINDOWS SHOULD HAVE EXCESS HEATING SURFACE.

Provision should always be made in buildings having no mechanical ventilation, but which must depend on window ventilation, for heating surface in excess of that required to offset normal

TEST OF JOHN C. GORMAN CO'S SHOP - WHOLESALE MERCHANT TAILORS - 4TH FLOOR McNULTY BLDG - 103 W VAN BUREN ST
CHICAGO COMMISSION ON VENTILATION

Station	Occupants	Temperature Dry Bulb	Temperature Hot Bulb	Rel. Hum. %	Dust Particles per C.F.	Bacteria 2 min Plate	Odors Percent Freedom	CO_2
1	10	63	49	34	40000	26	90	6.6
2	9					40	90	7.2
3	10	64	50	36	25000	18	90	7.0
4	11					12	90	9.2
5	9	67	52	35	27000	31	90	8.3
6	4						85	9.4
7	9	65	50	32	15000	21	85	7.3
8	5					18	90	9.8
9	7	64	50	36	12000	29	85	7.8
10	9						85	8.8
11	3	64	50	36	6000		95	10.8
12	3					20	85	9.6
13	3	61	48	37	5000		90	7.9
14	3					35	90	7.8
15	2	65	51	38	3500		90	8.6
16	1						95	6.8
17	0	60	48	40	3000		95	7.9
18	2					8	95	7.6
19	0						90	6.1
20	8	63	50	39	5000	28	80	9.4
23	2	61	48	38	15000	15	95	7.0
24	0						95	6.1
25	1					8	95	6.5
Ave.	110	63.4		36.5	14200	22	90	7.9

Time: 11 A.M.-12.30 P.M. Date: May 29-1917
Weather:-Clear Temp 47° Rel. Hum. 50%
Wind:-Dir.-N.W., Vel.-10 M.P.H. No heat on this floor.
Floor Area = 6700 Sq. ft. Ceiling = 10'-10" Window Space = 600 sq. ft.
Air-Space = 72,000 cu. ft. Space per occupant = 650 cu. ft.
7 Gas Lamps using 12 cu. ft. gas each = 84 c.f.h. Total
15 Gas Irons using 10 cu. ft. gas each = 150 c.f.h. Total
234 c.f.h. gas ≡ 213 c.f.h. CO_2 ≡ 355 persons
7.9 Parts CO_2 with 465 occupants ≡ Air Supply of 12,000 c.f.m.
Measured Air Supply = 13,500 c.f.m. - Exhaust = 14,900 c.f.m.



DATA SHEET NO. 3, JOHN C. GORMAN COMPANY SHOP, SHOWING CONDITIONS WITH WIND FROM NORTHWEST.

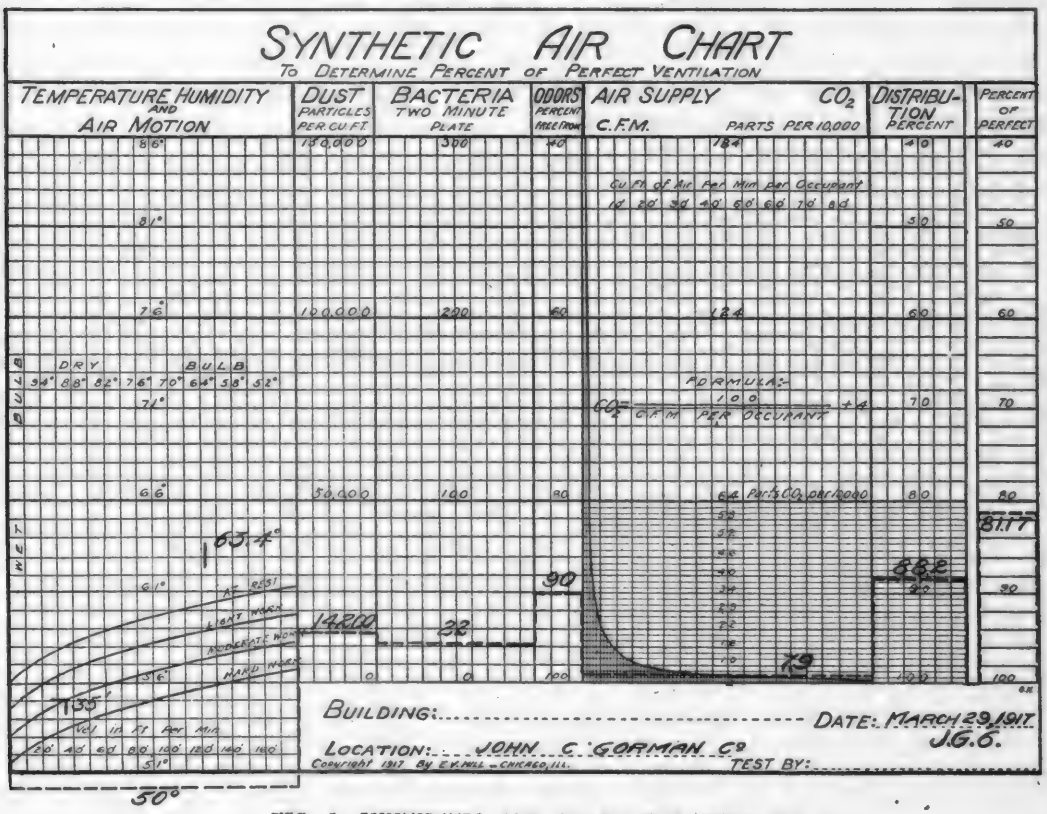


FIG. 5—SYNTHETIC AIR CHART FOR TEST NO. 3.

losses. This excess surface must be sufficient to warm the air admitted for ventilating purposes. Unless the radiation is placed adjacent to the air inlets and unless it has this excess capacity, there will be objectionable cold drafts, such as were observed in this building. The leakage factor normally provided in proportioning direct radiation is one air change per hour. Under the conditions in effect where windows are used for ventilation, this leakage factor must be increased by adding the maximum ventilation requirement. Failure to provide this excess radiation inevitably must result in the entire elimination of ventilation in cold weather.

Mechanical ventilation on the exhaust principle should be provided for the interior toilet. As arranged, when there is any ventilation of the main room, there is a tendency to withdraw toilet-room odors through the door. Such a contamination would be impossible if consistent exhaust ventilation of the toilet room were in effect.

Wardrobe Ventilation for School Buildings

Tests for Dust and Bacteria Conducted by Detroit Board of Health on Air Exhausted Through Cloakrooms.

By W. F. WALKER,
Sanitary Engineer, Detroit Board of Health.

In the summer of 1917 the Board of Health of Detroit, Mich., was requested to investigate the practice of exhausting air from school class rooms, through the wardrobes and to report to what extent the results of such practice were detrimental to the health of the children.

The problem, naturally resolved itself into two components: First a study of the extent to which dust is deposited or filtered out on the outer garments hung in the wardrobes and the possible danger of such dust, and second: The possible transmission of germs of communicable diseases through the medium of the outer garments. The investigation by the Board of Health was carried on at the Duane Doty School, being a typical example of that class of schools ventilated in this manner. Observations were not made at other schools as the general principles applied to all of those of this class.

EQUIPMENT FOR VENTILATING DUANE DOTY SCHOOL.

The Doty School is mechanically ventilated, air being drawn from above the roof through an air intake to the basement heated and discharged into the room at the rear about 8 ft. above the floor, at the rate of about 1,500 cu. ft. per minute. The air is forced well to the front of the room, and travels back through the breathing zone at low velocity and leaves the room through the wardrobes at the rear, the sliding doors of which are so arranged as to leave an 8 in. by 36 in. opening at the floor. About 60% of the air supplied finds its exit this way. The rest is lost by leakage through windows and doors.

METHODS OF MEASURING DUST IN AIR LEAVING ROOM.

To determine the amount of dust present in the air leaving the room samples were collected by means of the Palmer apparatus (described in *The American Journal of Public Health* for January 1916) 6 in. above the floor, at the opening into the wardrobe. To determine the amount of dust deposited, samples were taken with the same apparatus in the attic, the Palmer appara-

tus being placed in the flue opening leading from the wardrobe. The result of this examination showed that on an average 0.781 grams of dust were deposited per day somewhere between the opening into the wardrobe and the outlet of the flue. This method is faulty in that only the lighter dust would be carried up the flue by the ascending air column; heavier particles which might be present in the air near the floor would not show themselves in the analysis of the air at the outlet.

Because this method did not give us the true condition, a study of the air dustiness was made by a method devised by Dr. E. Vernon Hill and described by him in THE HEATING AND VENTILATING MAGAZINE for June, 1917. This method consists in microscopically counting the dust deposited on a cover slip from a known volume of air. The average of the observations made show the following results:

Number of dust particles per cubic foot in air entering room, 24,000; average number of dust particles per cubic foot in air in front of room in breathing zone, 26,200; average number of dust particles per cubic foot in center of room in breathing zone, 32,600; average number of dust particles per cubic foot in wardrobe, 16,400.

It is evident from these and other observations, that the amount of dust in the wardrobes is not so great by 50% as in the room, and that the children's garments hanging in the wardrobes are as safe from dangerous dust as they are when hanging in the average home and safer than when being worn upon the street.

DETERMINING DANGER OF TRANSMISSION OF COMMUNICABLE DISEASES.

To determine the danger of transmission of communicable diseases, bacteriological examinations of the air were made by exposing nutrient agar plates at various locations, for periods of 2 minutes, incubating 48 hours at 37° C. and counting colonies. The minimum count of those plates exposed in the room in the breathing zone was 5, the maximum 48, with an average of 15. The examination does not show any stratification.

The results of the analysis in the wardrobe show the minimum count to be 7, the maximum 48, with an average of 16.

It is noticeable in this instance, however, that plates taken above the clothing at a height of 5 ft. from the floor frequently show a count in excess of a plate simultaneously taken near the floor, there being some evidence that the clothing gives some dust and some bacteria to the air.

It is conclusively shown that the clothing does not act as a filter to any appreciable extent, and that the danger of contact infection from child to child or of droplet infection by coughing or sneezing greatly outweighs any possible danger of transmission by means of outer garments.

All of which facts lead to the conclusion that the practice of exhausting air from the school room through wardrobes cannot be considered in any way detrimental to the health of the children.

THE HEATING AND VENTILATING MAGAZINE
A Monthly Journal of Engineering Progress
Member of the Associated Business Papers Inc.

Vol. 15 **April, 1918** **No. 4**

Published Monthly at Cooperstown, N. Y., by the
Heating and Ventilating Magazine Co.
Executive and Editorial Offices, 1123 Broadway
New York
A. S. ARMAGNAC.....*President*
GUSTAVE PETERSEN....*Secretary and Treasurer*

A. S. ARMAGNAC, Editor
GUSTAVE PETERSEN, Business Manager
HAROLD L. ALT, Contributing Editor

European Representative:
W. G. HOLLINWORTH, 304 High Holborn
London, W. C.

Subscription.....$1.00 per year
Canada..... 1.25 " "
Foreign Countries..... 1.50 " "
Back numbers..... 15 cents each
Back Nos. prior to current year.. 25 cents each

As these words are written the armies in Europe are engaged in the mightiest struggle in the history of the world. The issue of that struggle may long remain in doubt, but, in these critical days, there is no doubt in the minds of red-blooded Americans as to the final issue of the war. As one American officer put it, when asked how long the conflict would continue: "If you can tell me how long it will take to defeat Germany, I will tell you when the war will end." President Still of the heating engineers' society expressed it equally well when he said, "The only thing that matters is the winning of the war."

Our course, therefore, stretches out before us, straight and clear. Every American soldier in France and every American sailor on the seas must and will be backed to the limit. Just at this time, that backing resolves itself into the putting over of the Third Liberty Loan. In spite of the fact that the amount of the loan will be $3,000,000,000, instead of a higher figure, and that the interest rate will be 4¼%, make no mistake about it—every ounce of effort will be needed to make the loan a success. We cannot afford to fail—the matter is too vital. The army here and in the trenches will receive a wonderful inspiration when the news reaches them that the loan is not only an overwhelming success but that "there is more up the river than has ever come over the falls."

WHAT your Liberty Bond will accomplish:

A $1,000 bond will buy six cases of operating instruments for a base hospital, or furnish pistols for a rifle company, or one motor kitchen.

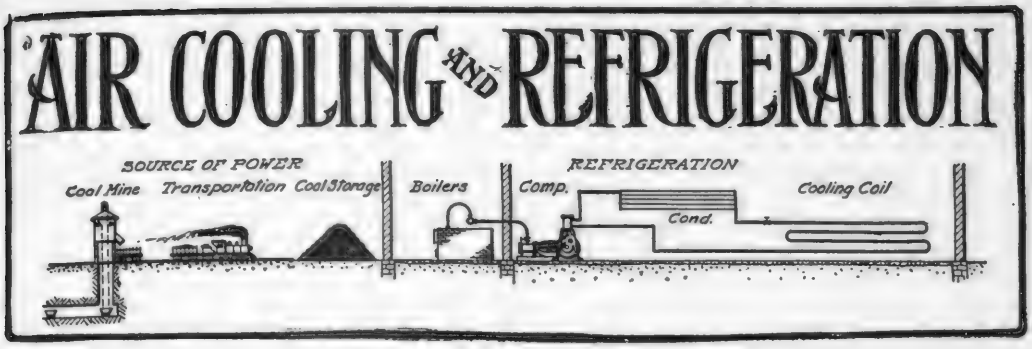
One thousand five hundred dollars of Liberty Bonds will buy a motor ambulance, or a motor car for a machine-gun battalion.

Two $1,000 bonds will buy a motor truck; three $1,000 bonds will buy rifles for a Field Artillery battery, or supply horses for a Field Signal battalion.

Four $1,000 bonds will buy a tractor; five $1,000 bonds will buy one Liberty truck, or seven Lewis machine guns, or equip a rifle company with rifles.

Six $1,000 bonds will buy a Liberty motor; seven $1,000 bonds one training plane; nine $1,000 bonds one observation balloon.

Ten thousand dollars of bonds will fully equip three hospital wards of 50 beds each, with all linen, clothing, and other necessaries, or buy six large wholesale sterilizing outfits, or six motor ambulances.



A Non-Gaseous Refrigeration Machine

Cooling as a result of the evaporization of water is well understood by ventilating engineers, its application being constantly used in air washer work. That such cooling can be extended under proper conditions to the point of refrigeration will, perhaps, come somewhat as a surprise to many; yet it can easily be seen that if a small cooling effect is obtainable under ordinary conditions it only remains to increase this cooling effect sufficiently under artificial conditions to produce the required drop in temperature necessary for refrigeration.

As has been previously explained in these columns, practically all modern refrigerating machines employ an easily compressible gas, such as ammonia, carbon dioxide, etc., and obtain the cooling action by first compressing the gas, cooling to a resulting liquid, and then permitting it to evaporate under reduced pressure. But the simple evaporation method has much to commend it in its simplicity and its independence of special chemicals and high pressures, for which reason numerous attempts have been made to utilize it commercially. None of these were successful, however, until Maurice Leblanc solved the problem and designed a new type of re-

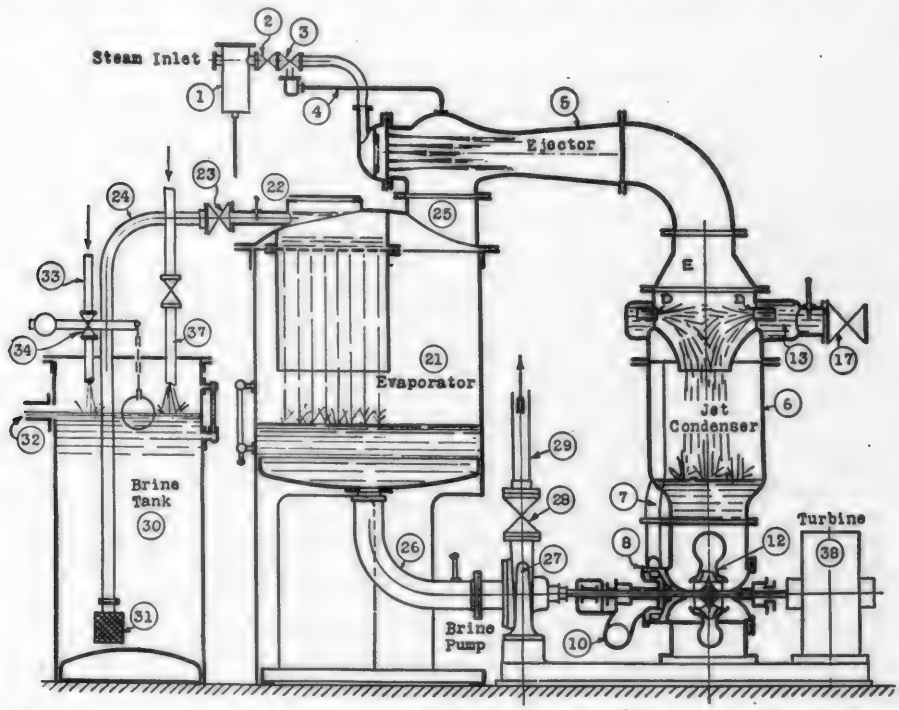


FIG. 1.—DIAGRAMMATIC ARRANGEMENT OF WESTINGHOUSE-LEBLANC REFRIGERATING MACHINE.

frigerating machine which is now being manufactured by the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

The operation of this machine can be

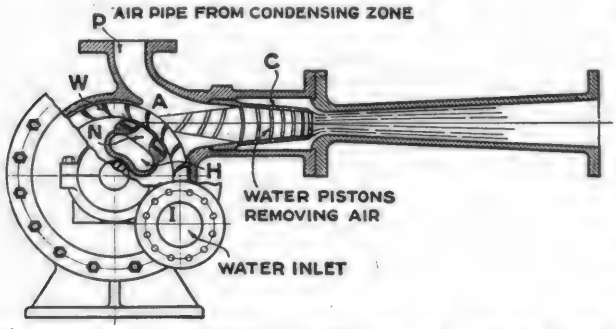


FIG. 2.—CROSS-SECTIONAL VIEW OF AIR PUMP SHOWING PRINCIPLE OF OPERATION.

readily understood by reference to the diagram, Fig. 1, in which 30 is a storage tank for brine, 21 a large vessel called an evaporator, 6 is a condenser, and 8 is an air pump. The air pump maintains a high vacuum in the whole system beyond valve 23 between the brine tank and the evaporator. It is evident that when valve 23 is opened brine will be drawn into the evaporator, where, passing through a sieve at the top, it falls in the form of a fine spray. Since the pressure within the evaporator is very low much of the brine will evaporate instantly. In doing so it must absorb heat and since there is no other source for this heat except that part of the brine that did not evaporate, the portion that collects in the bottom of the evaporator has a low temperature. This is the refrigerant. It is pumped out by pump 27, run through pipes to wherever the cooling effect is wanted, and finally returned to tank 30.

The effectiveness of the operation depends, of course, in keeping a high vacuum within the evaporator and the evaporated spray would soon destroy this vacuum if it were not promptly removed. This is accomplished in a unique way by having the vapors rising from the evaporator meet a jet of steam from an ejector at the top of the outlet pipe; this jet sweeps the vapors into the condenser where both steam and vapors are condensed. The condenser can be of any type, jet, barometric, or surface, to suit the conditions of the installation.

Failure of previous attempts to use the principle of evaporating water was caused by the fact that no air pump could be found that would maintain continuously the necessary high vacuum. The air pump 8, is therefore a very essential element in the success

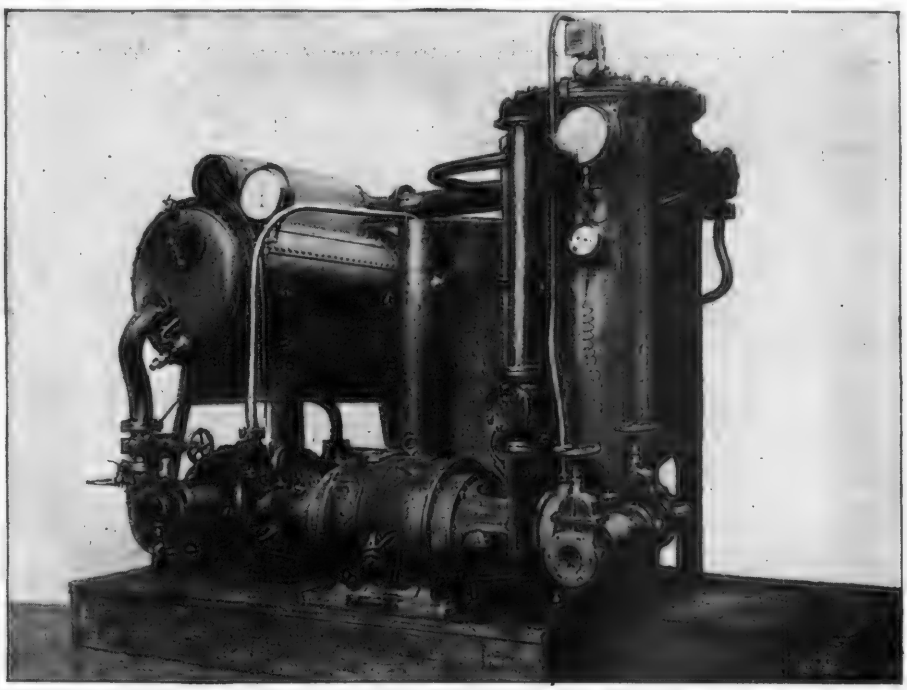


FIG. 3. WESTINGHOUSE-LEBLANC REFRIGERATING MACHINE READY FOR OPERATION.

of the brine evaporating machine. An enlarged diagram of this pump (an earlier invention of Mr. Leblanc) is shown in Fig. 2. It closely resembles an ordinary centrifugal pump except that it has two inlets, one for air and one for water, (7 and 10 in Fig. 1). The water is discharged by the rotating runner in the form of detached pistons which carry the air out with them. Since there is no opportunity for back leakage in this pump, it creates and holds a high vacuum without difficulty.

The Westinghouse-Leblanc refrigerating machine is made in a variety of sizes and styles for all kinds of refrigerating service, water cooling, air cooling, ice making, etc. Requiring no compressor it is economical in space and weight over the ordinary refrigerating machine, and its efficiency is stated to be proved by tests to be fully as high. It is evidently simple to operate and requires little attention being, at the same time, safe because it uses neither a dangerous gas nor a high pressure.

Small Refrigerating Units.

1.—JOHNS-MANVILLE A-S MACHINE.

One of the small machines suitable for household and small demands is the well-known Audiffren-Singrun refrigerating machine or, as it is more easily termed, the Johns-Manville A-S machine.

In brief its characteristics involve the use of a small amount of power (generally electricity), can be operated by any unskilled person, is hermetically sealed requiring no re-charging, operates on the compression system using sulphur dioxide as the refrigerating agent and never requires lubrication except for the two bearings which carry the machine.

The machine itself is simply a shaft carrying at one end a drum and at the other a pulley; in the middle of the shaft a second drum is hung. The general external appearance is strongly suggestive of a large dumbbell as shown in Fig. 1 and when erected ready for operation the end drum is partially submerged in the liquid to be cooled—usually brine. The middle or condenser drum is also partially submerged in another tank, this drum being in contact with the cooling water which must be kept running during the operation of the machine in order to carry away the heat.

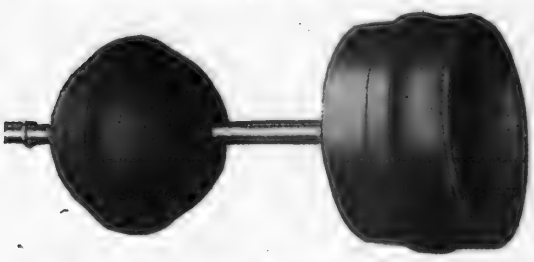


FIG. 1.—THE JOHNS-MANVILLE A-S REFRIGERATING MACHINE.

The compressor hangs loose on the shaft inside the condenser drum, being held in proper position by a counterweight which in itself automatically determines the amount of pressure which can be produced with the compressor. A cross-section of the compressor end of the dumbbell is shown in Fig. 2 and its method of operation may be described as follows:

OPERATION OF A-S MACHINE.

On the shaft inside of the drum at the middle of the shaft hangs a double-acting, two-cylinder compressor. This compressor has its suction connected to the cold or refrigerating drum through one of two passages in the shaft. As the machine revolves, the compressor, which is held down by a counter-weight, draws gas from the refrigerating end of the machine, thereby reducing the pressure in the refrigerating end and causing the sulphur-dioxide liquid to evaporate, thereby producing refrigeration. The gas which has been drawn away from the cold end of the machine is discharged into the spherical drum within which the compressor is itself located. In this drum it is condensed by contact with the walls which are in turn cooled by the condensing water, and the liquid, being held out by centrifugal force against the periphery of the machine, is caught by a spoon or scoop and drags it down to a cup at the top of the compressor where the oil is separated and sent back over the compressor, while the liquid sulphur dioxide is passed by means of a float valve back to the cold end of the machine ready to re-evaporate. Devices are also provided in the cold end of the machine for returning any oil that may accumulate in this side of the machine back to the high pressure side.

In case the condensing water gives out, the counter-weight will not hold the compressor in position beyond the time when the condensing pressure rises to a certain predetermined level. When this occurs, the counter-weight allows the compressor to revolve with the machine and, therefore, the pressure cannot rise, due to the action of the machine, beyond a certain fixed point. In this way it is impossible to cause dangerous pressures in the apparatus.

There are no joints, no stuffing boxes and no gauges to watch. All the operator needs to do is to revolve the machine and keep the condensing water flowing. The

machine is frequently arranged with automatic control so that a thermostat starts and stops the apparatus in accordance with the temperatures existing in the material or compartment being cooled.

In the process of the construction of the dumbbell the air is entirely exhausted therefrom and a charge of sulphur dioxide and a neutral oil is injected, the drums being then permanently sealed. During operation the working parts of the machines are lubricated by the pressure in the condenser which constantly forces the oil between the working surfaces. As air is not present inside the drums oxidation of the oil cannot occur.

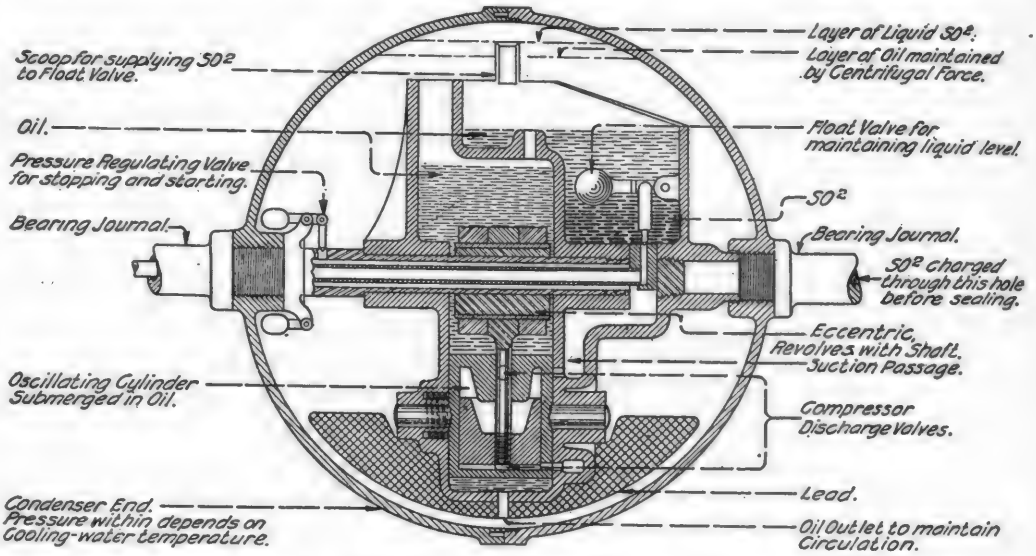

Layer of Liquid SO2.
Layer of Oil maintained by Centrifugal Force.
Scoop for supplying SO2 to Float Valve.
Oil.
Float Valve for maintaining liquid level.
Pressure Regulating Valve for stopping and starting.
SO2
Bearing Journal.
Bearing Journal.
SO2 charged through this hole before sealing.
Eccentric, Revolves with Shaft.
Suction Passage.
Oscillating Cylinder Submerged in Oil.
Compressor Discharge Valves.
Lead.
Condenser End. Pressure within depends on Cooling-water temperature.
Oil Outlet to maintain Circulation.

FIG .2.—CROSS-SECTION OF COMPRESSOR END OF JOHNS-MANVILLE A-S REFRIGERATING MACHINE.

These machines may be obtained in four standard sizes—or multiples thereof—the single unit sizes being as follows:

No.	Rating—Tons (Approximate)	Ice per Hr. lbs.	K.W. per hr.	Water, Gal. Per min.
2	1/5	11	0.6	0.75
4	1/2	27	1.25	1.66
3	1	55	2.25	3.25
6	2	110	4.50	6.5

A view of the A.S. machine set up ready shown in Fig. 3; in this drawing the ice is for ice making and refrigerator cooling is made in the ice cans I set in the ice tank IT which is partially filled with brine B The dumbbell is driven by the motor M and operates the circulating pump P which circulates the brine from beyond the ice cans through the pump suction line PS and the pump discharge line PD to the refrigerator and back to the ice tank underneath the refrigerating end of the dumbbell. The condenser C contains the cooling water (supplied through the cold water line CW) and the compression end of the dumbbell; the cooling water gradually runs off to waste through the waste pipe W.

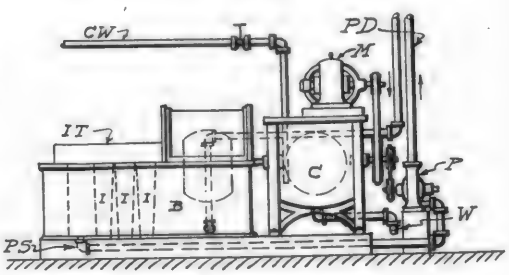


FIG. 3—JOHNS-MANVILLE A-S MACHINE SET UP.

A new booklet on the "Economy of Patented Cold Storage Doors" has just been issued by the Jamison Cold Storage Door Co. of Hagerstown, Md.

A Challenge to Service

Engineers Face to Face with a Crisis in Connection with Adequate Remuneration for their Services.

By F. H. NEWELL,

Head of Civil Engineering Department, University of Illinois, Chairman Committee on Engineering Co-Operation, American Association of Engineers.

Today we as engineers are face to face with a crisis in our affairs, second in importance to us individually only to the work of winning the war. The majority, whether members of engineering societies or outside them, are wage earners, though we love to camouflage this hard fact, under the more attractive term of salaried men.

This crisis is the inevitable result of the steady, long-continued decline in the standard of money value, the shrinkage in the purchasing power of the dollar, reflected in the commonly accepted term "The high cost of living." Our wages fixed by law or custom, suited to the conditions of years ago when the dollar had twice its purchasing power, are now inadequate. Our savings accumulated by self-denial are worth only about half what they were when we in youth put the money in the bank. Even with the added interest we can buy fewer of the necessities of life. We are practically poorer though we have observed the rules of thrift, unless—as few have done—we have been so fortunate as to invest in things to sell. Then we discover that we have made a double profit due to this same shrinkage of our measuring stick.

Others of our fellow wage earners, men who have invested little, if anything, in education, who have the most rudimentary training, who are employed as day laborers under our direction, are getting larger rates of pay. We have come to regard as a matter of course the anomaly that the engineer or trained assistant in charge, the man who is supposed to supply the training and exercise judgment is getting less than the carpenter, mason, or plumber working under his orders. Yet he must—according to our tradition—live in a little better house and maintain his family and educate his children in a more expensive way.

It is getting harder and harder to do this, and now the breaking point is about reached. Some are solving the difficulty by actually going into manual occupation. Men who have been assistant engineers in charge have found that they can get better wages by taking up the saw and hammer and entering the ranks of day labor.

The question is why do not more go, leaving this relatively poorly paid profession.

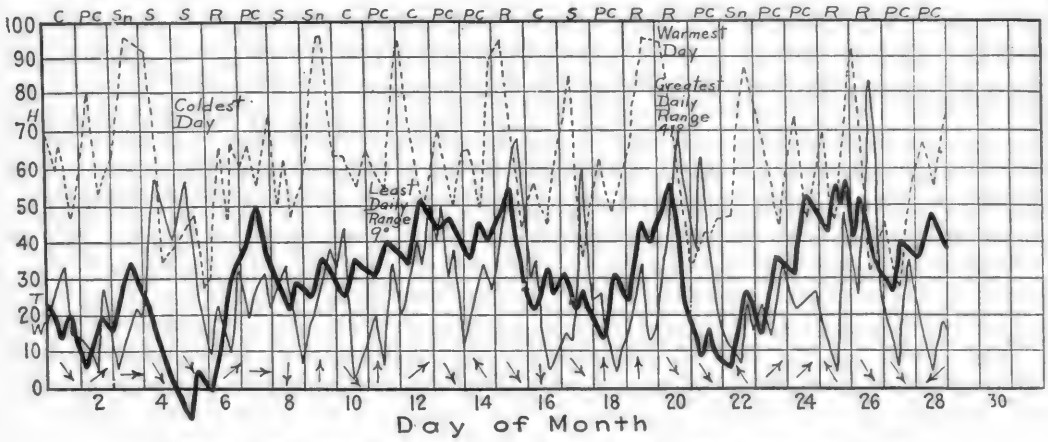
But should this be permitted? Is there not some way by which the sunlight of publicity can be turned into the dark corners of under-payment? Is it necessary that each for himself must solve the problem and single-handed struggle against a condition which is nation wide? What are others doing under the circumstances? The architects, the doctors, the lawyers, have increased their rates through the action of their organizations. It goes without saying that united labor has been heard and the response has been immediate, but what about the various associations of engineers? We have, it is true, no one all embracing society, comparable to that of European countries, nevertheless our societies are well organized and powerful if they choose to utilize their forces. What have they done or what are they proposing to do? The challenge for service to the membership lies before them.

The reply is "we were not created for any such purpose." Our rules and traditions confine us to the discussion of technical papers, relating to materials, or to the forces of nature, not to human factors. Our business is to maintain a high professional standard through lectures and publications and not through considering the condition of our members.

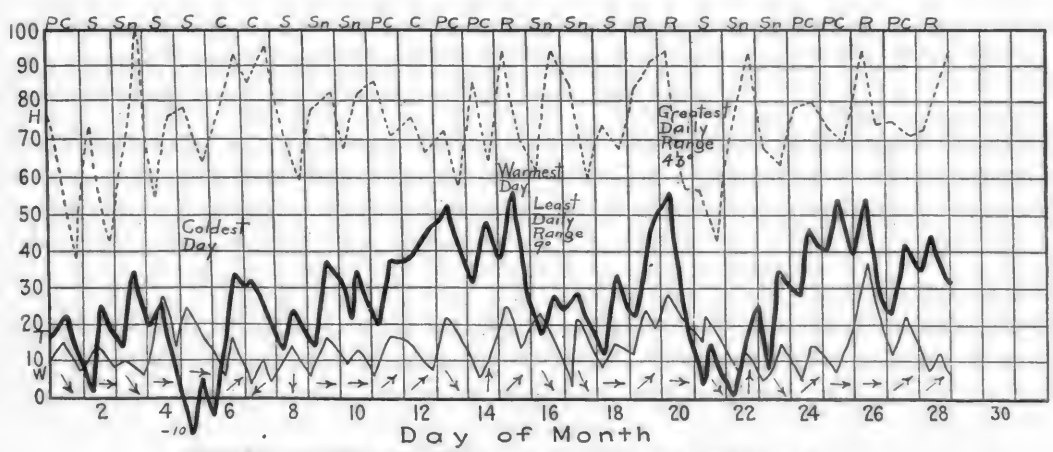
These members, however, are beginning to ask the question as to whether this is the correct or proper reply. They are realizing that times have changed and that while the engineering societies at their inception may have included a larger proportion of independent engineers, they now have a membership made up of 75% or more of wage earners. They are asking whether under this condition, where they are paying the great part of the expense of the societies, they should not receive some return directly or indirectly, other than through scientific publications.

The Weather for February, 1918

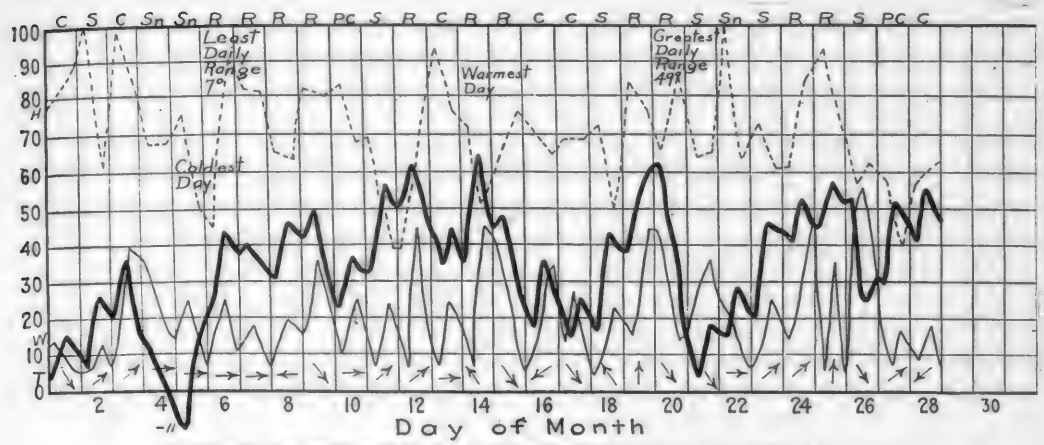
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	58	57	64	61	70
Date of highest temperature	20	15	14	14	19
Lowest temperature, degrees F	—7	—10	—11	—10	2
Date of lowest temperature	5	5	5	4	4
Greatest daily range, degrees F.	41	43	49	38	51
Date of greatest daily range	20	20	20	19	19
Least daily range, degrees F.	9	9	7	4	6
Date of least daily range	11	16	7	28	27
Normal temp. for month, degrees F.	29.6	27	33	27.2	35.6
Mean normal temp. for month, degrees F.	30.7	28	31.8	25.4	33.5
Total rainfall, in.	1.98	2.3	1.87	2.81	2.09
Total snowfall, in.	3.5	5.7	2.3	8.4	0.2
Normal precipitation, this month, in.	3.74	3.44	2.66	2.16	2.75
Total wind movement, miles	14555	8221	9506	9386	11243
Average hourly wind velocity, miles	21.7	12.2	14.1	13.9	16.7
Prevailing direction of wind	N. W.	S. W.	S. W.	S. W.	S.
Number of clear days	5	6	7	6	12
Number of partly cloudy days	13	13	5	13	7
Number of cloudy days	10	9	16	9	9
Number of days on which rain fell	6	5	10	7	6
Number of days on which snow fell	3	7	3	6	1
Snow on ground at end of month, in.	None	Trace	None	2.6	None



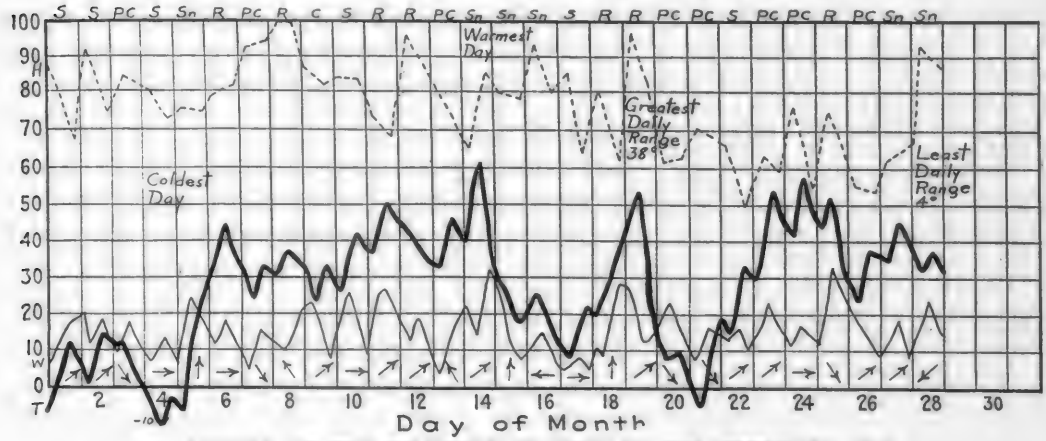
RECORD OF THE WEATHER IN NEW YORK FOR FEBRUARY, 1918.
(HOURLY OBSERVATIONS OF THE RELATIVE HUMIDITY ARE PLOTTED ON THIS CHART.)



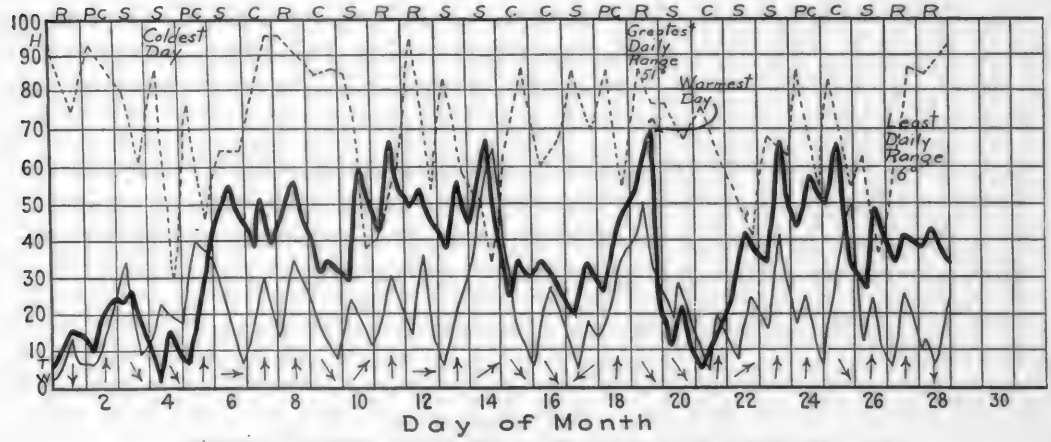
RECORD OF THE WEATHER IN BOSTON FOR FEBRUARY, 1918.



RECORD OF THE WEATHER IN PITTSBURGH FOR FEBRUARY, 1918.



RECORD OF THE WEATHER IN CHICAGO FOR FEBRUARY, 1918.



RECORD OF THE WEATHER IN ST. LOUIS FOR FEBRUARY, 1918.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.

S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

The War and the Heating Engineer

The Liberty Loan Honor Flag.

A new and distinctive feature will be introduced in the Third Liberty Loan campaign, and every city or town in the country which subscribes more than its quota of Liberty bonds will be awarded by the Treasury Department an Honor Flag.

The flag will be 36 in. wide and 54 in. long. The body of the flag will be white with a broad red border, and three broad blue vertical stripes denoting the Third Loan. The flags which will be of the same quality as the flags of the Navy, are already being manufactured and will be awarded as fast as the right to fly them is won. Though awarded by the Treasury Department, they will be distributed by the Liberty loan committees of the different districts.

There will also be a National Honor Flag for each State, to be flown at the State capitol, with the name of each town winning a flag inscribed upon it. There will be also preserved in the United States Treasury a National Honor Flag, with the record of each State recorded on it.

Stars, to be placed on the flag of each city or town doubling its quota, will be also awarded, and an additional star for each time the quota is doubled.

An Honor Roll, containing the names of all subscribers, but not the amount of the individual subscriptions, will be kept in each community. A window card, bearing a representation of the Honor Flag, will be given each subscriber to the loan, to be displayed at the home or place of business.

Extensions of Army Cantonments.

With the coming of Spring the work of rounding out the construction of the great army cantonments is commencing to occupy the attention of engineers and contractors. The success with which the hastily-constructed camps met the phenomenally severe test of the past winter is well known, but it has also been well understood that as soon as opportunity offered the cantonment quarters would be placed on a more permanent basis.

At Camp Custer, located at Battle Creek, Mich., work has already begun on the enlargement of the base hospital. This is the first step of a Spring building drive which will not only double the camp's capacity, but will include the brick veneering of many if not all of the buildings, together with changes in the heating system.

The necessity for the latter changes lies in the demonstration during the winter that much fuel was wasted and steam lost because of exhaust steam pipes led from the barracks into the open. The proposed change calls for the installation of a return system.

One of the reasons for extending the Northern barracks is that the soil formation in the South is unsuited for training and many of the soldiers in the Southern training camps will be moved North.

Emergency Fleet News.

The accompanying illustration shows the metal badge given to every volunteer for

SHIPYARD SERVICE BADGE
ISSUED BY GOVERNMENT.

service in the shipyards. The badges are being distributed as fast as they can be sent out from Washington.

With the advent of the volunteer workers, Uncle Sam will have about 450,000 skilled men actually at work in shipyards. That shows what can be done in a little over a year's time. The following figures speak for themselves. In 1916, the wage-earners in steel shipyards of the country numbered:

Steel shipyards	43,582
Wood shipyards	1,380
Total	44,962

On January 1, 1918, the workers numbered:

Steel shipyards	181,273
Wood shipyards	23,437
Total	204,710

Add the 250,000 men who will respond to the call for shipyard volunteers and the grand total when we get into full swing will be 454,710 shipbuilders.

A feat that is amazing to the layman is being performed on the Great Lakes, where mighty ore carriers that ply ordinarily between Duluth and the ports of Lake Erie are being cut in two so they may pass through the Welland Canal to the Atlantic and put into service in war trade. It is impossible for these vessels to be taken through the canal as they were built. Engineering science solved what would seem to the layman an insurmountable problem. These monster vessels are divided in the middle by an acetylene flame; the open end inclosed and half of the ship is taken through the canal. The other half follows and, in the St. Lawrence, the two are joined together again.

Legislation for Central Control.

Pending action by Congress on the enactment of laws to bring about a more central control and responsibility for procuring war material and supplies, the Chamber of Commerce of the United States is engaged in developing plans which it will recommend for the reorganization of the several Government departments affected. The Chamber of Commerce is in favor of dropping the agitation for a ministry of munitions and a war cabinet on account of the opposition to this measure by the Administration and now favors the idea of radically changing the existing machinery to bring about the desired central control and responsibility. To this end support is urged of the so-called Overman bill which authorizes the President to rearrange the distribution of war activities between the executive bureaus and departments and to employ, if necessary, additional agencies.

Higher Salaries for Government Technical Men.

The American Association of Engineers has inaugurated a movement to secure higher salaries for technical men employed by the railroads now under the control of the Government. The appeal is being made to the United States Government Wage Commission and the association points out that all engineers will be indirectly benefited by such an increase. It has been found that the average monthly salary for a draftsman is $90.00 per month, the salaries running up to $150 for division engineers. The increase urged by the association is 50% additional to the present salaries.

American Business Men Discuss War Questions.

As we go to press the sixth annual meeting of the United States Chamber of Commerce is being held in Chicago, the dates being April 10-12. Business readjustment to war is the dominant note of the meeting. The four critical questions of the day—financing the war, railroads, centralized control of industry and shipping, are being considered from the two-fold point of view of filling the government's requirements with the minimum disturbance to private industry.

Why Moving Clocks Ahead Will Help Win the War.

Now that the Daylight Saving plan has become a reality, its effect on the daily lives of practically all of us forms a topic of the liveliest interest. From the heating engineers' standpoint the principal effect of the scheme is in the immediate reduction in the use of light and heat, with its attendant conservation of coal. More than 1,500,000 tons of coal a year is the estimated saving and the saving in fuel oils is equally impressive.

Calculations computed for different periods based upon the actual British experience in the summer of 1916, and modified by allowances for differences in latitude give the following savings in coal for the United States:

(1) Saving of 150 hours of a yearly average of 1320 per year requiring artificial illumination in the U. S. (i. e., by daylight saving between second Sunday in April and last Sunday in September):

In electricity for lighting	660,000 tons coal
In gas for lighting.....	144,000 tons coal
	804,000 tons coal

(2) Saving of 190 hours from the yearly average (i. e., with clocks moved ahead one hour between April 1 and November 30):

In electricity for lighting	836,000 tons coal
In gas for lighting.....	183,000 tons coal
	1,019,000 tons coal

(3) Saving of 198 hours from the yearly average (i. e., with clocks advanced one hour throughout year):

In electricity for lighting	871,000 tons coal
In gas for lighting.....	190,000 tons coal
	1,061,000 tons coal

These figures do not include the saving which would be obtained at isolated plants and at electric power plants which sell power for lighting. To be borne in mind, too, is the fact that the estimate has been made on a basis which assumes the use of electric energy and gas for lighting is spread evenly over the country whereas as a matter of fact 57,000,000 electric lights out of a total of 76,000,000 in the country are in New England, Middle Atlantic and Northern Central states where the advantages of daylight saving will be most striking.

The saving of coal through substitution of a morning hour of moderate illumination for an evening hour of maximum use of electricity and gas illustrates ways in which very important savings in coal would be obtained.

For example, take the Commonwealth Edison Company of Chicago. The peak load of this company is needed for no more than one and one-half hours a day. The average load is less than 50% of the peak. The investment and equipment to produce the peak is upwards of one-fourth of the whole and equals $25,000,000. Daylight saving will do two very important things for this and similar companies. First, it will materially reduce the peak load required for domestic and industrial lighting; second, it will place the greatest demand for power for transportation farther within the hours of natural light in place of having it simultaneous with the high demands for artificial light as it is under present conditions during many months of the year.

In addition to a saving of coal amounting to hundreds of thousands of tons, daylight saving will also enable these companies to postpone new investments in equipment to carry the peak of the load which would amount to millions of dollars. This postponement will come at a time when it is of the highest public interest to avoid all new financing that is possible. The situation of the Commonwealth Edison Company is typical. In 1916 it had a generating capacity of 360,000 kilowatts. At the end of 1917 it had increased this to 452,000 and according to plans made it will, under present conditions, have to raise this to 600,000 kilowatts by the end of 1919. Such growth is not abnormal and may be said to be typical of scores of similar companies throughout the country. The new order will enable them to conserve capital which would otherwise be spent in extending their equipment.

Heating Men in Military Service.

H. E. Sproull, formerly manager of the Dallas and Salt Lake City branches and assistant manager of the Cleveland office of the American Blower Company, has received his commission as first lieutenant, C. A. R. C., at Fortress Monroe, Va. He has been assigned to Battery D, 64th Heavy Artillery, at Jackson Barracks, La.

Oversubscribed.

The issue of $500,000,000 of United States Treasury certificates, the subscription to which closed March 5, was oversubscribed, the subscription in every district, except one, exceeding the quota assigned it.

The banks of the country in the past two Liberty Loan campaigns and in the purchase of Treasury certificates issued before the loans responded to the demands of the country with inspiring loyalty and liberality. The faith they show in the Government finances and the patriotic response they give to the calls of the Treasury are certain indications that their cooperation and assistance will help to insure the success of the Third Liberty Loan.

American and English Income Taxes.

In comparison with the tax levied in England on incomes our own income taxes are moderate, indeed.

In England the tax on incomes of $1,000 is 4½%, in America nothing.

In England the tax on incomes of $1,500 is 6¾%; in America nothing for married men or heads of families, and 2% on $500 for an unmarried man.

In England the tax on an income of $2,000 is 7⅞%; in America nothing for a married man or head of a family, and 2% on $1,000 for unmarried men.

The English income tax rate also increases more rapidly with the growth of the income than ours, a $3,000 income being taxed 14%, $5,000 16%; $10,000 20%, and $15,000 25%, while our corresponding taxes for married men are respectively two thirds of 1%, 1½%, 3½% and 5%, and only slightly more for the unmarried, due to the smaller amount exempted, the rate being the same.

Clean Coal the Key to the Fuel Problem.

E. G. Bailey, president of the Bailey Meter Co., Boston, Mass., was one of the lecturers in the J. E. Aldred lecture series at the Johns Hopkins University, Baltimore, Md., February 28. Mr. Bailey's subject was "The Coal Problem." After discussing the coal troubles of the past winter which, he stated, were greatly aggravated by the poor quality of coal delivered, Mr. Bailey proposed as a remedy that standards of quality be established for coal and that a premium be offered for clean coal.

"The price paid to the operator," he said, "should be based on standards established by the Fuel Administration according to different mining districts, etc., with premiums based almost entirely upon percentage of ash, and especially the free ash as slate and rock which can and should be eliminated at the mines.

"Coal-sampling stations should be established by the Government at certain central points where large quantities of coal are received direct from mines such as New York, Philadelphia, Baltimore, Hampton Roads and the lake loading ports, each station being equipped with machinery for obtaining representative samples from as many individual cars as necessary to determine the average quality of coal shipped from each mine during each month.

LOAD CARS WITH THE CLEANEST COAL

"The operator would not know what cars were to be sampled, for the Fuel Administration could consign or reconsign any cars in transit to the coal piers or power houses where the sampling stations were located. The mine operator would therefore have a real incentive to load every car with as clean coal as possible.

The car distribution at the mines, which is an important point to the operator, should also be based upon the quality of coal produced so that there would be an added incentive to load clean coal, and the market would always be supplied with a greater proportion of the better quality of coal, than if the empty cars were prorated equally among the poorer and better mines as at present.

"Actual knowledge of the quality of coal would also be of great benefit to the Fuel Administration in classifying various mines into pools so that the consumer and particularly the railroads would receive coal of uniform quality, thereby enabling them to obtain maximum capacity and efficiency in the combustion of this coal.

"There is sufficient labor at the mines to clean the coal, and the railroads can haul enough good coal, but they cannot get the necessary heat units to the consumer if they must be burdened with hauling 30,000,000 tons of unnecessary dirt. We have our choice of either building thousands of locomotives and a hundred thousand cars and adding to the terminal facilities of our railroads within the next few months or removing the excessive impurities from the coal. The latter can be done quickly and effectively. It is the only feasible remedy for our present coal problem."

Success of America's War-Savings Campaign.

For their respective first three months the American war-savings campaign is running ahead of the English campaign. America is pouring into the Treasury at the rate of about $2,000,000 a day—over $75,000,000 up to date.

The direct comparison is:

	ENGLAND	AMERICA
First month.....	$ 5,172,000	$10,236,451
Second month....	2,719,000	24,559,722
Third month.....	3,402,000	41,148,244
Total.....	$11,293,000	$75,944,417

The $75,944,417, of spending already put at the service of the Government by the buyers of war-saving securities has transferred from millions of patriotic, saving citizens to the National Treasury command of the labor and materials to build a fleet of about one hundred 5,000-ton ships.

How to Place Tracing Cloth at Service of the Red Cross.

A new appeal for discarded draftmen's tracing cloth is being sent out by the American Red Cross. It is stated that this cloth can easily be handled by modern laundries. Manufacturers, architects and engineers are asked to call up the local laundry owners' association or one of the large laundries of his city and he will find the laundrymen glad to send for such cloth as they have on hand. Some of the tracing cloth is thin linen fabric and some is thin cotton but either one makes no difference in the washing process. The cloth has been treated with a gelatinous dressing to make the material take ink and at the same time be transparent. Malt extract, or diastase, is used in the laundries to remove this dressing, although a cold rinse, followed by a hot suds, will serve. The goods are given a fairly strongh bleach, followed by a sour, to remove traces of bleach. Then there should be a good rinse, to remove every trace of the sour. The bleach, it is pointed out, will completely sterilize the goods.

Philadelphia Heating Trade Establishes Coal-Saving Stations.

A remarkable movement to teach the principles of fuel conservation has been inaugurated in Philadelphia under the direction of a committee of men in the heating and coal industry, known as the Committee on Practical Fuel Conservation of the Federal Fuel Administration. Already fifteen instruction stations have been opened in different parts of the city and have attracted large numbers of people. None of the instructors is allowed even to suggest what is the best heating apparatus nor are any of them permitted to mention his own name or that of the manufacturer. At least one instructor is always at each station ready and willing to answer questions in regard to the saving of fuel.

Printed instructions are handed out for operating boilers, warm-air furnaces and coal cooking ranges. The boiler-operating rules are reproduced herewith, together with one of the posters published by the Federal Fuel Administration for Philadelphia.

Name .....

Address .....

State Whether Residence, Store or Apartment Building .....

Detached ..... Twin ..... Inside ..... Corner .....
(STATE WHICH)

Number of Rooms ..... Is Porch Heated? .....

State Kind of Heating, whether Vapor ..... Steam ..... Hot Water .....
Warm-Air Furnace .....

Do You Use Coal Range? .....

Total Number of Tons of Coal Burned Per Year .....

If you are interested in learning how to reduce your coal bill, mail this card at once to the Federal Fuel Administration for Philadelphia.

☞ NOTE. This does not require stamp—Drop in nearest letter box

POST CARD SENT OUT BY FEDERAL FUEL ADMINISTRATION OF PHILADELPHIA.

Directions for Operating Hot-Water, Steam Boilers and Warm-Air Furnaces

Coaling

Keep fire pot full of coal, up to bottom of the coaling door, sloping upward to the back, BECAUSE a full fire pot means less care, even heat and saving of coal.

Control of Fire

Keep draft damper in ashpit door closed as much as possible Open only enough to keep an even-burning fire.

Regulate turn damper in smoke hood or smoke pipe and open adjustable cold-air check damper in smoke hood or smoke pipe to control the fire.

Slide or wheel damper in coaling door should be kept closed in daytime and open at night.

Care of Grates

A short, quick stroke of the shaker handle will sift the ashes through the grates.

Leave grates in flat position at all times.

Keep fire pot free from clinkers.

Clean ashpit daily, to prevent damage to grates.

In severe weather grates should be shaken until a glow appears in ashpit. Then fill up fire pot with coal to bottom of coaling door, sloping upward to the back. In moderate weather a bed of ashes should be carried on top of the grates.

Cleaning of Boiler or Furnace

Clean boiler or furnace flues weekly, BECAUSE an accumulation of soot on flue wastes coal.

Warm-Air Furnaces

When fresh-air supply is directly from cellar, a cellar window near furnace should be partly open.

When fresh-air supply is through a wood box or metal pipe, damper should be adjusted to provide enough air to keep lower half of casing of heater cool to touch. At night partly close damper in air supply.

Steam Boilers

Keep glass gauge of boiler half full of water, BECAUSE water higher than this reduces the amount of steam and water lower than this may damage the boiler.

Hot-Water Boilers

Keep system filled with water to bottom of expansion tank.

Remove air from system weekly by opening air valves at top of radiators, BECAUSE radiators filled with air will not heat.

General

Coaling door should be opened only for filling fire pot with coal.

Ashpit door should be opened only for the removal of ashes.

Sift your ashes to save coal. Slightly moisten siftings before using again

Keep water pan in warm-air furnaces filled at all times.

Keep open dish filled with water near radiator in each room, BECAUSE moist air is more healthful and comfortable at 68 degrees than dry air at 75 degrees.

NOTE: Should your boiler or furnace need proper dampers, consult your heating man.

RULES FOR OPERATING HEATERS ISSUED BY PHILADELPHIA COMMITTEE ON PRACTICAL FUEL CONSERVATION.

The chairman of the executive committee is H. D. Kellogg, of the H. B. Smith Company and the other members are: T. C. Mahady, secretary; W. A. Bland, C. P. Hackett, C. V. Haynes, E. S. Berry, B. F. Johns, A. C. Mott, H. W. Plucker, and W. E. Tinker.

The general committee is made up of the following firms:

Abram Cox Stove Co.
American Radiator Co.
Bridgman Bros. Co.
Borden Stove Co.
Crane Company
Continental Heater Co.
Dunham Co., C. A.
Federal Radiator Company
absorbed by National Radiator Co.

HELP SAVE ANTHRACITE COAL

LEARN HOW

BY VISITING ANY

INSTRUCTION STATION

OUR TRANSPORTS BURN IT INSTEAD OF SOFT COAL TO PREVENT DISCOVERY BY SUBMARINE

TWO SHOVELS OF COAL SAVED DAILY IN PHILADELPHIA HOMES MEANS

100.000 TONS SAVED MONTHLY

FEDERAL FUEL ADMINISTRATION

POSTER ON FUEL CONSERVATION SENT OUT BY THE FEDERAL FUEL ADMINISTRATION OF PHILADELPHIA.

Fleck Brothers Co.
Fowler & Wolfe Mfg. Co.
Gurney Heater Mfg. Co.
Hart & Crouse Co.
Haynes Selling Company
Johnson Co., J. D.
Keystone Supply & Mfg. Co.
Lord & Burnham Co.
National Radiator Co.
Pierce, Butler & Pierce Rad. Co.
Page Boiler Co., W. H.
Richardson & Boynton Co.
Richmond Radiator Company
Smith Co., H. B.
Spear Stove & Htg. Co.
Sheppard Co., Isaac A.
Spencer Heater Co.
Union Radiator Co.
United States Radiator Co.
Vapor Vacuum Co.
Warren Webster Co.
Warm Air Heating Asso.
Williamsport Radiator Co.

The Uses of Coal in the United States.

In his address at the recent annual meeting of the heating engineers' society on coal conservation, Professor L. P. Breckenridge showed a number of lantern slides giving statistics of the coal industry in the United States. One of the most interesting was one on the uses of coal in the United States for 1910. For bituminous coal these figures are:

	TONS
Industrial steam trade	143,765,500
Railroads	122,000,000
Domestic and small steam trade	71,338,489
Beehive coal	42,278,516
By-product coke	19,554,382
Exported	18,773,782
Steamship bunker fuel	10,707,507
Steam and heat at mines	9,798,681
Coal gas	4,563,579

For anthracite, the figures are:

Domestic	47,338,100
Steam	31,560,400
Railroads	6,200,000
Exported	3,965,255

The New Rules for the Sale of Coal and Coke.

In connection with the recent order of the United States Fuel Administration regulating the making of contracts by operators, producers and jobbers of coal and coke, the Wholesale Coal Trade Association of New York has passed resolutions seeking to obtain a modification of the order which is characterized as leading to confusion and distress.

The resolution states that the sections of the order relating to the power of the fuel administration to cancel contracts and to the liability of requisition by the fuel administrator (Sections 4 and 5) make a contract very indefinite and that a producer can give no assurance to the consumer of the quantity of coal that he will receive under such a contract. A request is made that the fuel administration modify the above-mentioned clauses so as to make it possible for the producer and owner of coal to make binding contracts with consumers and manufacturers, if necessary, naming the essential consumers and limiting the quantity of coal to be sold to non-essential consumers in such manner as may be found needful and proper after investigation by the fuel administration.

CORRESPONDENCE

Novel Scheme for Heating Garage.

EDITOR HEATING AND VENTILATING MAGAZINE:

I would like to make a suggestion in reply to your correspondent's request for information on heating a detached garage with hot water. About seven years ago I had the same problem and solved it as per diagram. The house was warmed by an overhead system with balanced returns. For the garage an independent main was taken from the boiler and carried to and across the basement ceiling, then down and across to the garage through a crock conduit, then in the garage up to the ceiling, forming a coil at the ceiling, then down to the radiator and back to the boiler. The idea was that the coil near the ceiling being placed near the doors, where the heat losses were the greatest, would act as a cooling coil, causing a great difference in temperature in the main. This would cause a rapid circulation and force this warm water through the feed main to the garage.

In operation it was a perfect success and in all these years it has never failed to heat the garage perfectly. The scheme has been since used by others in Saginaw. By placing valves where shown the garage circuit may be shut off at any time and all the water drained off, as the garage is on an independent circuit. I suggest this as a simpler method than piping to the attic and back again in the house in order to get to the garage.

The articles in your magazine have been of great assistance to me in my heating problems and I offer my little "bit" in the hope that you may find them of some use to your readers.

Saginaw, Mich. J. F. B.

Our correspondent's sketch is shown in Fig. 1 and illustrates another method of heating a detached garage with hot water. There is no doubt that this scheme possesses certain advantages as follows:

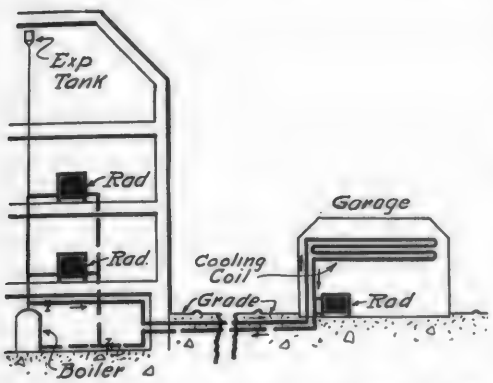


FIG. 1.—CORRESPONDENT'S SOLUTION FOR HEATING DETACHED GARAGE WITH HOT WATER FROM HOUSE SYSTEM.

No line is necessary up to the attic and back again in the house, as our correspondent has pointed out.

There is, therefore, saving of pipe and cutting.

There is less heat loss on the line—due to its shortening—and the radiation from the pipe (necessary to produce the circulation) takes place in the garage where the heat is needed, instead of in the house where it is not wanted.

The disadvantages we see consist of the following:

No automatic air vent is provided for the high part of the circulation loop on the basement ceiling.

If an air relief pipe is provided here to free this pipe from air it must be run up to the expansion tank, involving at least half the cutting and piping shown in the original scheme.

There must be two heating surfaces used in the garage (the coil and the radiator) and the coil—according to our correspondent's sketch—is in series with the circulation so that it cannot be shut off without stopping the circulation.

An air valve must be placed on the coil to relieve it from air.

The major portion of the heat from the hottest water is developed on the ceiling where it is not as desirable as when all the heat is developed at the radiator on the floor. Ceiling coils, where excessive leakage of cold air—as from the opening of doors, etc.—is encountered are never as satisfactory as surface placed near the floor.

From the foregoing we are inclined to the opinion that the scheme previously illustrated in these columns would give better results but that our correspondent's idea is a good substitute if for any structural or other reason the first arrangement cannot be used.

An Army Hospital Heating Problem.

EDITOR HEATING AND VENTILATING MAGAZINE:

The writer is preparing plans and specifications for heating a group of hospital buildings for the army. Am planning to use a direct radiation system of steam heating, distributing the steam at about 80 lbs. pressure from the boilers and reducing at each building to about 20 lbs. In order to avoid underground work as much as possible I am planning to carry the main returns overhead.

A New York engineer had done some work on this layout previous to my being placed in charge of the work and his plans call for connecting groups of radiators into a return below the floor, connecting this return into a bucket trap, and thence elevating the returns overhead, as shown on the enclosed sketch.

I am of the opinion that the steam will tend to short-circut through the radiators nearest the source of supply and prevent the proper return of condensation from the radiators near the end of the line. It has seemed to me preferable to place a thermostatic trap, and possibly a check valve on each individual radiator and elevate the condensation to the overhead return main at once.

I would like very much to have your opinion of the relative merits of the two schemes.

War Dept., Washington, D.C. B. O. P.

The system in question is illustrated in Fig. 1, but our correspondent does not furnish information on two important items, *viz.*, whether the trap discharge goes back against any pressure and whether the radiators have automatic air valves or pet cocks. As it is stated that the steam is generated at 80 lbs., we do not assume that the bucket trap at 20 lbs. will be expected to discharge

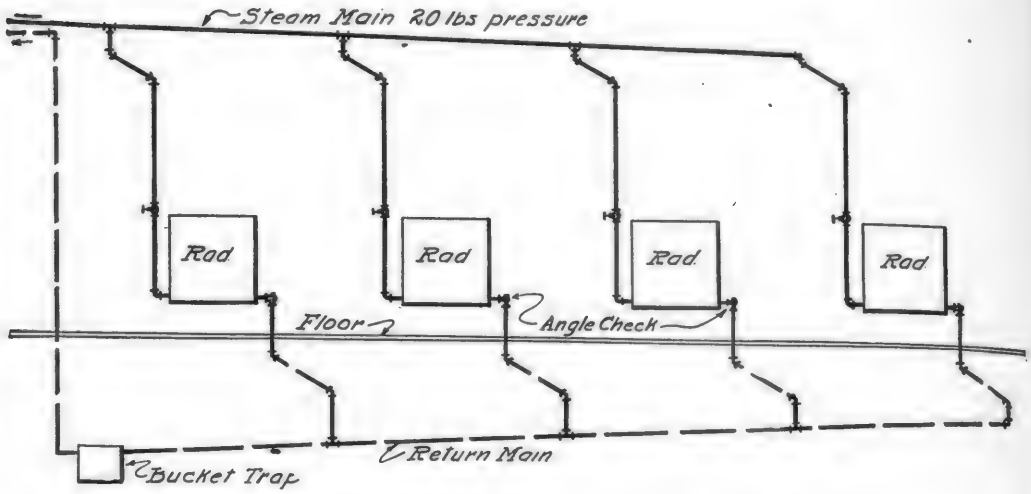


FIG. 1.—CONDITIONS OF PROBLEM FOR HEATING ARMY HOSPITAL.

directly back to the boilers, but it might go to a receiver in which pressure is carried or it might go to an open feed-water heater in which some pressure would have to be maintained. On the other hand, the return might be graded and vented so as to have no pressure on it except atmosphere.

If the trap discharge has no back pressure to operate against the bucket trap will lift the return approximately 2 ft. for every pound pressure in the return line. If the discharge goes back against a lower pressure, say 5 lbs. or so, such as would be the case if discharged into a feed-water heater, the bucket trap will lift the return approximately 2 ft. for every pound excess of return pressure over the discharge back-pressure against which the trap operates.

If the discharge goes back against the same pressure as in the steam main the trap will not lift and, in fact, will not operate at all, due to some drop in pressure occurring in the steam passing through the radiator.

To get rid of the air when the system is started up automatic air valves, pet cocks, or other devices must be used, as a bucket trap will not handle air; in fact, an air-bound trap will not handle even water as long as the bucket remains full of air. It is a question if automatic air valves will give good service when operating on 20 lbs. of steam pressure. Our experience is that above 7 or 8 lbs. leakage is liable to occur. Under the conditions given we recommend that every radiator and the trap should have a pet cock which can be shut off when the air is blown out.

Our correspondent raises the question of short-circuiting, but we believe that there is little danger of this if the steam supply branches and radiator connections are sized properly so as to prevent excessive drop in pressure in passing through the radiators, thus maintaining on the return main to the trap approximately the same pressure as on the supply main. If such conditions are maintained then the condensation from each radiator will naturally find its way down into the return line by gravity.

On the other hand, if the supply branches are not large enough to furnish the radiators with steam as fast as they condense it and with but little loss of pressure in the radiator, then the pressure in some of the radiators might drop to a lower point than the pressure in the return line, resulting in holding back the return from such radiators and even drawing up steam and water into the radiator through the return connection. The angle check called for would prevent this reverse flow, of course, but it would hinder rather than help the return leaving the radiator since a slight addition head of water would be required to open the flap of the check.

Therefore, we recommend that each radiator should have a common supply and return valve for shutting off and no short circuiting will occur with proper sizing of pipes as long as 20 lbs. of steam is kept on the radiators and the system is free of air.

If the supply pipes are too small the only remedy would be to connect each radiator return to the return main through a water seal deep enough to counterbalance any difference in pressure existing between the radiator and the main.

Reducing Velocity to Pressure.

EDITOR HEATING AND VENTILATING MAGAZINE:

Please tell me how to reduce velocity to pressure and vice versa. I have a "Kent's" handbook but due to the fact that I cannot change velocity to pressure, I cannot use the formulas. I also wish you would answer this question: in a certain power plant, the steam is used only for heating purposes. High-pressure steam is produced at 80 to 90 lbs. gage pressure, what is the loss when this steam is reduced to 5 to 6 lbs. gage for the low-pressure heating system? The heating system is a vacuum return system and, from a test run the other day, I discovered the following fact, at 10 lbs. on the heating system the feed-water came back colder than at 4 lbs. Why?

Utica, N. Y. C. A. C., JR.

The velocity pressure of air flowing in a duct or flue under a barometric pressure of 29.92 in. of mercury is given by the formula:

$$VP = \frac{V^2}{8\frac{1}{2}\ (460 + t)}$$

when VP = velocity pressure in inches of water.
V = velocity in feet per second.
t = temperature of air in degrees F.

For example, air flowing through a duct at 1200 f.p.m. and at 100° F. temperature will have a VP of

$$\frac{1200/60 \times 1200/60}{8\frac{1}{2} \times 560} = \frac{400}{4760} = 0.084 \text{ in. of water.}$$

The velocity pressure is useful in measuring the flow of air in ducts by means of the Pitot tube in which the static and total pressures are obtained and the velocity pressure found by subtracting the static pressure from the total pressure.

A relation can also be established in steam and compressed air lines where the velocity increases due to the reduction in pressure on the gas and the consequent expansion of same. If a case is assumed where the drop in pressure is such that the volume of 1 lb. of gas at the outlet end of the pipe were twice the volume at the inlet it follows, of course, that the velocity at the outlet end of the pipe must be double that of the inlet in order to handle the larger volume. Therefore this increase in velocity may be attributed directly to the drop in pressure and divided by the number of pounds drop the quotient would represent number of feet increase in velocity to every pound of drop.

In regard to the loss of heat when high-pressure steam is passed through a reducing valve and is reduced to a lower pressure, it may be said that if the steam pressure is reduced through a reducing valve there is little if any heat lost; if the steam pressure is reduced by being passed through an engine the heat loss will approximate 10% due to a portion of the heat being transformed into work and another portion lost by condensation within the engine. In a reducing valve the additional heat contained in the high-pressure steam goes to superheat the low-pressure steam after passing the reducing valve.

As to the returns coming back at different temperatures there is no reason why the returns on a vacuum system should come back warmer with low-pressure steam and colder with higher-pressure unless the traps on the radiators do not hold and are leaking more at the lower pressure and temperature on the inlet side. This action is often observable on the common automatic air valve used on radiators where they will leak both air and water under vapor or low-pressure conditions but will shut off perfectly tight at 5 lbs. of steam pressure or over.

Back Draft in Chimney.

EDITOR HEATING AND VENTILATING MAGAZINE:

The points made by T. W. R. in your February issue, regarding a back-draft in a chimney where three flues are connected to fireplaces, are not quite clear to me on some points. I do not see why the leaving of the door "D" open for an experiment without stopping the back-draft action, proves that the wind "does not blow on that side of the dwelling." The wind might not have been blowing on that side of the building at that particular time. Also, it must be remembered that the draft in a high flue is stronger than in a short flue for the same temperature difference between the gases and the outside air.

Although your correspondent states that a ventilator top "might effect the same results as a closed damper," I know of several cases where ventilator tops do help the draft considerably.

Neither can I see why the radiators on the basement ceiling should cause a reversal of the flue, either directly or indirectly. It is true they will make the air temperature at and near the ceiling somewhat higher and that at the floor somewhat lower than if floor radiation were used, but the increased variation of 10° between the floor and ceiling will not affect the flue action, as the

radiators do not create any additional air nor do they consume any.

The suggestion to cut a register or grille into the flue at the ceiling line does not help matters for even if this established a flow in the flue in an upward direction, it would at the same time kill the draft from the fireplace just as effectually as is now the case.

New York. READER.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Arrangements for Summer Meeting.

Announcement is made that Buffalo, N. Y., has been selected as the place for holding the summer meeting of the society. The dates are June 26, 27 and 28. This will bring the meeting earlier in the summer than usual, this being done partly to accommodate the members of the National District Heating Association, as that organization will hold no meeting this year. A special session for the benefit of the central station heating industry is being planned so that members of the National District Heating Association who are invited to be present, as well as others interested, may have an opportunity to discuss matters affecting their industry.

Committees for 1918.

At a meeting of the council held March 6 the following committees were named for 1918:

Committee on Code for Testing Low Pressure Heating Boilers: Homer Addams, chairman; John R. Allen, L. P. Breckenridge, Ralph Collamore, W. L. Fleisher, James F. McIntire, J. J. Blackmore, William H. Driscoll, L. A. Harding, Edwin A. May, Walter S. Timmis and Percy H. Seward.

Committee on Engineering Co-operation: John F. Hale, chairman; E. Vernon Hill and S. R. Lewis.

Committee on Research Bureau: J. I. Lyle, chairman; Harry M. Hart, J. D. Hoffman, William F. McDonald and Perry West.

Committee on Schoolhouse Standards: Frank I. Cooper, chairman; John D. Cassell, Frank G. McCann, Robert J. Mayer and John Howatt.

Committee on Standard Method for Testing Air Washers: A. E. Stacey, chairman; Harry M. Hart and E. Vernon Hill.

Committee on Standard Method for Testing Radiators: John R. Allen, chairman; C. W. Johnson and L. C. Soule.

Committee to Confer with Bureaus of Mines: J. Irvine Lyle, chairman; G. W. Martin and Perry West.

Committee to Confer with National District Heating Association: J. Irvine Lyle, chairman; A. S. Armagnac, William H. Driscoll and C. W. Obert.

Committee to Co-operate with the United States Navy Department: Walter S. Timmis, chairman; Willis H. Carrier, E. Vernon Hill, William H. Driscoll and Fred R. Still.

Committee to Determine the Most Effective Place for a Radiator in a Room: William F. Verner, chairman; John R. Allen and Ralph Collamore.

Representative on Census Committee of Engineering Council: Champlain L. Riley.

Nominating Committee: Percy H. Seward, chairman; J. D. Cassell, H. M. Hart, Frank K. Chew and E. E. McNair.

Recent Developments in Coal Mine Ventilation Described Before New York Chapter.

A subject that proved to be of unusual interest and timeliness engaged the attention of the New York Chapter at its meeting on March 21, when Thomas Chester of the American Blower Company, gave a talk on "Coal Mine Ventilation and Its Effect on Production." After presenting a carefully-prepared paper on the subject, Mr. Chester held the close interest of the members by presenting a series of stereopticon slides showing in detail the methods followed in mining the coal, the ventilation requirements and numerous views of important blower installations for this class of work.

Mr. Chester said that multiblade fans are now used almost exclusively for mine ventilation. A properly-ventilated coal mine will result in a 10% increase in coal production. It is the usual practice to arrange the fans for supply and exhaust, suitable damper doors being provided to effect the change in the direction of air flow. In exhausting general use is made of the evasé outlet with its restricted opening, giving a venturi-tube effect and greatly adding to the efficiency of the fan. These outlets give a characteristic appearance to the mine ventilating apparatus located near the opening of the shaft, resembling to some extent the old-style locomotive smoke-stack.

The views shown by Mr. Chester included views, of metal mines in which he

said, the need of ventilation is almost as great as in coal mines.

Previous to Mr. Chester's address, the members had the pleasure of listening to Sergeant Alexander Mason of the "Princess Pat" regiment of Light Infantry, who is one of the few survivors of the famous Canadian regiment that held the line at Ypres in 1915. Sergeant Mason gave a vivid account of his experiences in the trenches and how he received the wound that finally incapacitated him.

C. E. Scott was the chairman of the committee in charge of the meeting and among the guests was A. E. Stacey, Jr., secretary of the Illinois Chapter who presented the greetings of that organization.

President Frank K. Chew announced the death of Mrs. William J. Olvany, wife of the chapter's treasurer, and the chapter's sympathies were expressed by the members rising.

At the February meeting of the chapter a paper was presented by W. L. Fleisher, who was chairman of the committee in charge, on the use of school-house heating and ventilating systems for drying and preserving fruits and vegetables, as described in THE HEATING AND VENTILATING MAGAZINE for September, 1917. Mr. Fleisher discussed the subject from a practical standpoint, making the point that school children could be employed in connection with the work. The process itself would be conducted largely in the summer months when the school plants are ordinarily idle. He illustrated his address with lantern slides furnished by the Department of Agriculture.

On motion Mr. Fleisher was invited to present his paper to the society and it was further voted to recommend that the council release the paper immediately for general distribution.

Illinois Chapter Discusses "The Kingdom of Dust."

Dust determination and its effect on the human body, based on extensive experiments conducted by the ventilation division of the Chicago Department of Health, were presented at the March meeting of the Illinois Chapter by Dr. E. Vernon Hill, president of the chapter and head of the Ventilation Division. An interesting feature of Dr. Hill's address was a series of stereopticon slides in colors.

Previous to Dr. Hill's address a report was presented of the recently-appointed standardization committee, consisting of E. F. Capron, chairman; H. M. Hart and August Kehm. The report aroused a lively discussion and the committee was tendered a vote of thanks for its efforts.

August Kehm was called on to describe the steam heating system at Camp Grant, Rockford, Ill., which was installed under his supervision. A total of 672 separate buildings are supplied with steam on a tract of land 2 by 4 miles. The experiment of carrying the steam mains overhead on poles had worked out satisfactorily at Camp Grant. Icicles frequently formed, he said, in sunny weather when the mains were covered with ice and snow, while the steam pressures in the mains ran from 40 to 70 lbs.

A Research Bureau on Household Engineering.

For some time *Good Housekeeping Magazine*, of New York, has maintained what it has termed "Good Housekeeping Institute," where apparatus and devices advertised in its columns have been tested, both as to their construction and capabilities. Those successfully passing the institute's investigation have been designated in the advertisements with a star.

The institute has now issued a booklet describing in detail its equipment and operation, the text being accompanied by numerous illustrations of the testing laboratory, in some cases with tests under way.

Among the detailed results given are those on vacuum cleaners and water-heaters. It is stated very frankly that at present the dust-bag of vacuum cleaners seems to be the weakest point in vacuum cleaner construction (portable type). The first service test given every machine is one that records the amount of suction the machine is capable of developing. This is done according to approved engineering practice. In the next test the amount of current required to operate the machine is carefully recorded. As a further guide to the efficiency of the machine under test, current readings are taken both while the machine is in actual service and while it is at rest. In addition, the number of revolutions per minute of the fan blades are counted, again under testing and working conditions.

As a result of the institute's tests it is stated that approved vacuum cleaning ma-

chines will maintain from 10 to 12 in. of suction, and that the amount of current required for operation comes to about 150 watts, which at 10 c. per kw. hr., amounts to 1½c. per hour.

Finally that a vacuum cleaner showing 12 in. on the water tube and of satisfactory construction in other respects, will pull 44 grams of flour mixture out of 50 grams through a matting rug, the mixture being first placed underneath the rug. As a final test 50 grams of the mixture are placed on the surface of a thoroughly-cleaned velvet rug of heavy pile. In a recorded number of seconds the cleaner is passed back and forth once only over the rug and then the weight of the flour removed is accurately determined. As a result of its experiments the institute endorses 16 out of the 25 vacuum cleaners it has tested.

In the matter of water heaters the tests are conducted with equal thoroughness and it is stated that all the heaters tested have proved themselves not only efficient, but well made and durable.

No less than 43 pages of the boklet are given over to a list of devices which have been approved by the institute. These include portable vacuum cleaners; dampers, regulators, etc.; household electric fans; electric heaters; gas heaters; coal and gas ranges; refrigerators; water heaters; one humidifier (Buddington); and one ozonator (Sprague). Size 8½x11½. Pp. 64, with indexes.

Structural Service Department of the American Institute of Architects.

A notable work is being done by The American Institute of Architects in conducting in its *Journal* what is known as a "Structural Service Department." This department is conducted under the editorship of D. Knickerbacker Boyd.

The department was inaugurated in January, 1917, and during the first year the following subjects were treated:

January: Foundational Requirements, Steel and Iron, Cement and Concrete.
February: Stone Masonry, Stone and Lime.
March: Clay Products and Fire Resistive Construction.
April: Fire Prevention and Protection.
May: Timber, Lumber and Wood.
June: Electricity.
July: Gas.
August: Construction by the Government.
September: Plumbing.
October: Heating and Ventilating.
November: Metal, Plastic and Other Products.
December: Painting, Glazing and Miscellaneous.

The monthly installments were numbered serially to correspond with the number of the month in the year. For instance, the section on heating and ventilating, appearing in the October number of the *Journal*, is No. 10. This order will be continued so that the next installment of this subject will appear in October, 1918.

In addition to this work and supplementing it, the institute publishes annually "The Structural Service Book," containing, under one cover, the previous year's series of Structural Service Department articles.

Volume No. 1, of the "Structural Service Book," is now issued and sells for $3.50, while the *Journal* of the institute may be had for $5.00 annually, or $3.50 to members of the institute. The *Journal* is published at The Octagon, Washington, D. C., and either the *Journal* or the "Structural Service Book" may be obtained through the book department of THE HEATING AND VENTILATING MAGAZINE.

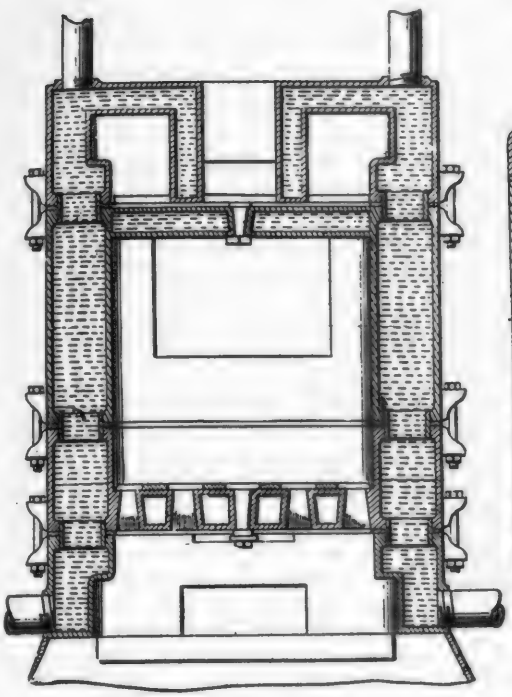
NEW DEVICES

New Type of Smokeless Boiler.

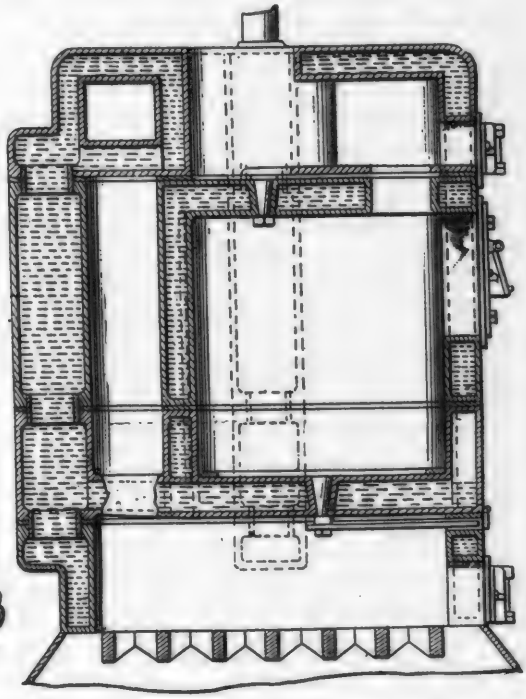
A new type of smokeless boiler for burning bituminous coal is being placed on the market by the Universal Smokeless Boiler Co., 411 Equitable Building, St. Louis, Mo. This heater is the invention of Edward H. Chenot, who is the secretary of the company. The boiler itself is of the upright, round type, of cast-iron, and contains a water-grate whereby a maximum amount of heat can be absorbed. It also contains a regulating shaker positioned on the water grate for obtaining a free flow of the products of combustion. It has three passageways for the circulation of the water. The boiler is made in three sizes for hot water, or steam.

In describing the principles involved in the design of his boiler Mr. Chenot states:

"The most important condition that make mechanical stokers successful in burning smoky coal without smoke is slow and uniform heating of the coal, with the result that a large part of the volatile matter is distilled at low temperature, and the distillation of the volatile



VERTICAL SECTIONAL VIEW OF UNIVERSAL DOWN-DRAFT BOILER, LEFT TO RIGHT, ILLUSTRATING REGULATING SHAKER POSITIONED ON WATER GATE.



VERTICAL SECTIONAL VIEW, FRONT TO BACK, ILLUSTRATING A SECTION OF THE WATER GRATE.

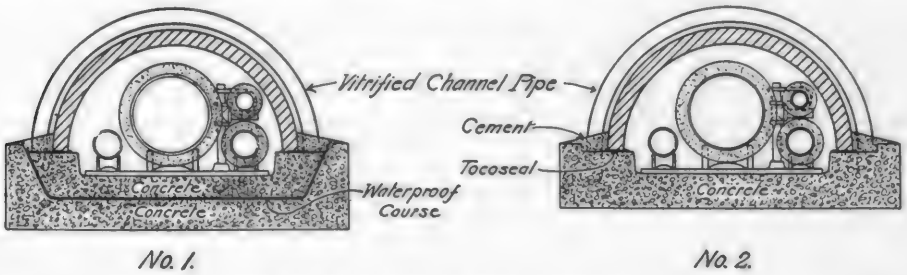
matter occurs in the presence of oxygen."

This principle is applied in the arrangement of the Universal smokeless boiler, together with principle that a long, narrow combustion space is more efficient in burning the gases than a short, wide one having the same cubical space. In the long, narrow space, the gases travel with a higher velocity which promotes mixing and therefore quickens combustion.

New Types of Steam Pipe Conduits.

A steam pipe conduit which, it is stated, combines the features of water-tightness, efficiency and durability, has been brought out by P. N. Kenway, 248 Boylston street, Boston, under the name of the W. E. D. steam pipe conduits. Among the advantages claimed for this conduit are that the pipe supports rest on a flat surface while the concrete lower portion forms a solid base on which to install the pipes; the longitudinal joint does not depend for tightness on the matching of the upper and lower sections of a split-tile pipe; all joints below the center are eliminated; the conduit can be broken into and repaired at a minimum of expense; any one of the pipes can be removed and replaced without disturbing the others; and the cost is reasonable.

As will be noted from the illustrations, the lower portion of the No. 1 conduit is



THE W. E. D. STEAM PIPE CONDUIT.

composed of an outer trough-shaped monolithic shell of concrete, a water-proofing course of Tocoseal and an inner monolithic shell of concrete. The upper portion consists of vitrified channel pipe with cemented bell-and-spigot joints. Tocoseal and cement are used for sealing the longitudinal joints.

No. 2 conduit is for use only in gravelly soil where drainage conditions are exceptionally good.

New Publications.

PERCENTAGE OF EXTRACTION OF BITUMINOUS COAL, with Special Reference to Illinois Conditions, is the title of a recent bulletin (No. 100) issued by the Engineering Experiment Station of the University of Illinois. The percentage of total available coal recovered in the process of mining is a factor of increasing importance under the present conditions when the demand for fuel is so abnormally high. Under the belief that the percentage of extraction at present is too low, especially in the mining of bituminous coal, the Engineering Experiment Station of the University of Illinois, in cooperation with the Illinois State Geological Survey and the U. S. Bureau of Mines, has undertaken an investigation of the subject and has made a somewhat elaborate study of the facts and information compiled. The work has been done under the immediate direction of Professor C. M. Young of the Department of Mining Engineering at Urbana and the results are published as Bulletin 100 of the Engineering Experiment Station.

The facts developed show that mining methods in many districts of West Virginia and Pennsylvania are yielding, under comparable conditions, a much higher percentage of extraction than those employed in the Illinois, Indiana and Western Kentucky field. It is shown also that there is an excellent opportunity to improve conditions in the Middle West field by more systematic methods of mining.

TRANSACTIONS OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS for 1917, covering the proceedings of the twenty-third annual meeting in New York, in January, and those of the summer meeting in Chicago in July, have been published, making a volume of 692 pages. In addition to the numerous papers and discussions that were features of these two meetings, the volume contains full reports of the business transacted, with lists of those in attendance, officers and committees, etc. The number of papers on drying and dehydration are an interesting commentary on the growing importance of this field to the heating engineer.

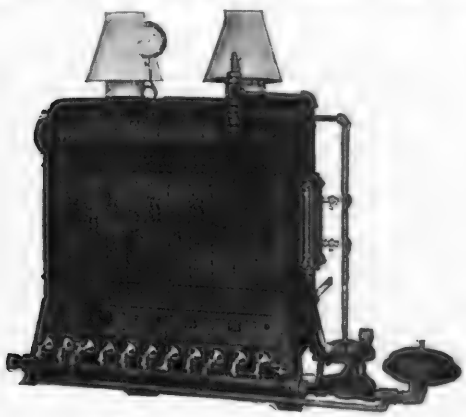
Trade Literature.

ELECTRICALLY-HEATED JAPANNING OVENS, by C. F. Hirshfield, reprinted from the N. E. L. A. Bulletin, and "Heat Calculation for Baking and Drying Ovens," by W. S. Scott, reprinted from the *Electric Journal*, are the titles of two articles of interest to those engaged in the heating of baking, drying and japanning ovens which have been reprinted, under one cover, by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The first article gives general considerations in favor of electrical heating for this purpose, while the second article gives a detailed method of calculation for the amount of heat required to raise the temperature of the work of the supporting and carrying parts, such as trucks, and of the ventilating air. How to compute the losses from the external surface of the oven, and the heat required to raise the temperature of the oven walls, etc., are also given. The publication is listed as Reprint 66.

IDEAL SPECIALTIES, including the Norwall siphon air valves, sylphon packless radiator valves, Arco temperature regulators and Sylphon water regulators, are the subject of recent circulars sent out by the American Radiator Co., Chicago, Ill. The Norwall siphon valve is shown in sectional views open and closed, illustrating how this valve relieves the radiator of air and prevents cold loops of steam radiators. Arco temperature regulators include three types of thermostats and three types of motors for regulating the draft of the heater. With this arrangement one-day or eight-day clock regulation may be secured, or regulation where clock control is unnecessary. In addition to the spring type of motor, there is also one equipped with a small electric motor and a third operated by a 10-lb. weight. The latter requires winding up more often than the spring motor. The Sylphon packless radiator valve it is stated, maintains the remarkable claims made for it that it is the only valve made which has no rotating or sliding parts exposed to the steam or water, and therefore that it cannot leak.

Ideal Sylphon water regulators are adapted for controlling hot water temperature in either water boilers or tanks. The circular on this device explains how this regulator is installed and operated and the statement is added that they are easily put on old outfits.

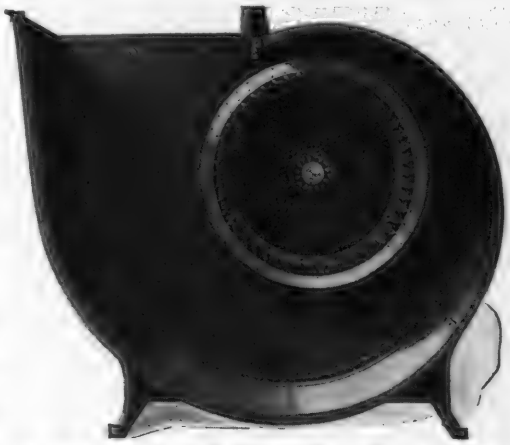
BRYANT WATER AND STEAM HEATING SPECIALTIES, heated by gas, are an interesting product of the Bryant Heater & Mfg. Co., Cleveland, O., illustrated and described in a recently-issued catalogue. One of the most notable features of these heaters is the arrangement of the fire travel. The space between the sections is staggered, forcing the heat to travel a distance of 4 ft. from the burner to the flue, during the whole space of which the heat is playing against the water passages. Baffle plates along the sides of the heater are designed to prevent the gases at these points from going direct to the flue and causing them to come in contact with the heating elements the length of their travel. A baffle plate is also placed in the top of the boiler to make the draft uniform and perfectly distribute the heat over the whole interior of the combustion chamber, regardless of the number of burners in use. The sections of the boiler are of cast-iron as are the burners. The burners which are centrally supplied, have drilled holes raised above the surface of the burner, with two



BRYANT GAS HEATER

holes drilled in each to carry the flame to the other burners. A full series of sizes is furnished for both steam or hot water. The company also makes a number of specialties, such as steam-coil thermostats, quick-acting gas cut-off valves and temperature regulators all of which are discussed in the catalogue. Size 4¾x7½ in. Pp. 64.

BAYLEY PLEXIFORM FANS, pulley, engine, motor and turbine driven, are treated in a noteworthy catalogue, just issued by the Bayley Mfg. Co., Milwaukee, Wis. The Plexiform fan, which is of original design, is constructed especially to meet the present-day requirements of a centrifugal-discharge fan, viz: maximum air delivery

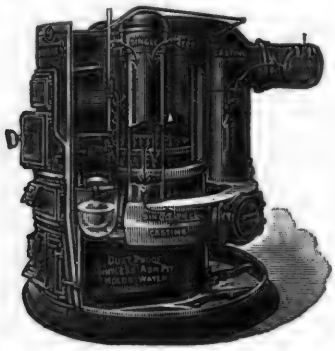


PLEXIFORM FAN WITH ONE SIDE OF HOUSING REMOVED TO SHOW INTERIOR.

against low or medium high resistance from a minimum of housing; highest obtainable mechanical efficiency, strength, lightness, quietness in operation, and a method of construction equally adaptable to high as to low pressures and as practicable for double-width as for single-width fans. The catalogue illustrates in detail how the Plexiform fan meets these requirements. The balance of the catalogue is given up to a well-arranged compilation of engineering data, which, for the most part, can be used in connection with any fan or ventilation problem. The fan tables themselves take up no less than 64 pages. The catalogue concludes with some typical layouts, together with 32 illustrations of different arrangements of overhung pulley and overhung wheel fans. Size 7¾ x 10½ in. Pp. 104.

ROUND OAK MOISTAIR HEATING SYSTEM is the description given to the warm-air furnaces, with humidifiers attached, manufactured by the Beckwith Co., Dowagiac, Mich. It is evident this company has recognized the demand for an adequate humidifying system for use with warm-air furnaces and the construction of the heater shows that a serious effort has been made to meet this demand. Although the water pan is not placed above the dome of the heater, it is located next to the fire-pot and is of considerably larger size than the usual water pan. Moreover, it is

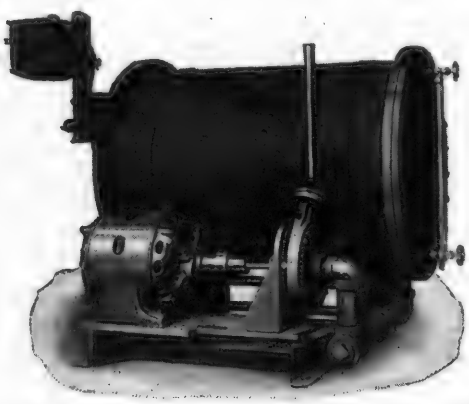
kept filled automatically. The company's catalogue is handsomely gotten up, with "X-ray" views of the heater itself, together with numerous views of the various



ROUND OAK MOISTAIR HEATER, SHOWING LARGE SIZE OF WATER PAN.

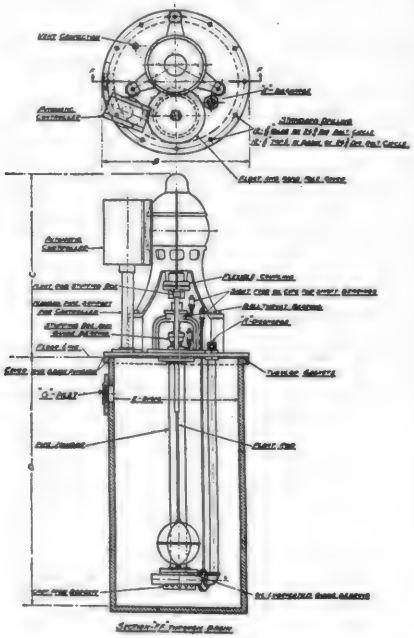
parts, supplemented by views of typical installations. The company announces that it has recently filled an order for 192 Round Oak Moistair heating systems for the homes of employees of the American Sheet and Tin Plate Company, being erected at Gary, Ind. Size 9x12 in. Pp. 26.

YEOMANS ELECTRICALLY-DRIVEN CONDENSATION RETURN PUMPS for automatically returning condensation to boilers in low-pressure steam heating systems, are brought to the attention of the trade in Bulletin No. C-5000, issued by Yeomans Bros. Co., Chicago. These pumps are furnished in two types. Type H, for installation above a point where flood water would be likely to submerge it, and Type V for installation below the floor line. Type H consists of a heavy cast-iron receiver, horizontal centrifugal pump and continuous-duty electric motor, with adjustable, float-operated, automatic starter



YEOMANS ELECTRICALLY-DRIVEN CONDENSATION RETURN PUMP.

of the carbon butt-contact type. Type V is of the well-known Yeomans bilge type, and consists of a heavy cast-iron basin or receiver ordinarily set in an excavation



CONSTRUCTION OF BILGE TYPE OF YEOMAN'S CONDENSATION RETURN PUMP.

with the top even with the floor line and to which is attached a steam-tight cast-iron cover. On this cover is mounted a continuous-duty vertical-type motor and yoke type dust-proof ball-thrust bearing from which is suspended by hanger and discharge pipes, a vertical, submerged-type centrifugal pump, with oil-immersed bearing. A float-operated automatic starter, with knife switch and fuses, mounted on the basin cover, controls the starting and stopping of the motor. Besides illustrating the two types and presenting, in tabular form, the characteristics of the various sizes, the catalogue contains typical forms for specifying Yeoman's pumps. Size 8½ x 11 in. (standard). Pp. 8 (punched for binding).

S. W. HUFFMAN, president of the Huffman-Conklin Co., Columbus, O.; heating and plumbing engineers and contractors, died at his home in that city February 28. Mr. Huffman was 62 years old and was an old-time figure in the heating and plumbing trade. He leaves a widow and two daughters.

PROPER GAUGES AND WEIGHTS OF ROUND G. I. PIPE AND ELBOWS FOR DUCT SYSTEMS

Gauge and Weight per Square Foot		Diam. of Pipe, In.	Weight per Lineal Ft., Lbs.	Weight of Full Ell Lbs.	Gauge and Weight per Square Foot		Diam. of Pipe In.	Weight per Lineal Ft., Lbs.	Weight of Full Ell, Lbs.
28 g.	0.78 lbs.	3	0.7	0.4	20 g.	1.66 lbs.	38	18.2	139.4
"	"	4	1.1	0.9	"	"	39	18.7	146.0
"	"	5	1.2	1.2	"	"	40	19.1	152.9
"	"	6	1.4	1.7	"	"	41	19.6	160.7
"	"	7	1.7	2.3	"	"	42	20.1	168.6
"	"	8	1.9	2.9	"	"	43	20.6	176.7
26 g.	0.91 lbs.	9	2.4	4.3	"	"	44	21.0	185.0
"	"	10	2.7	5.3	"	"	45	21.5	193.4
"	"	11	2.9	6.4	"	"	46	22.0	202.2
"	"	12	3.2	7.6	18 g.	2.16 lbs.	47	29.2	274.3
"	"	13	3.4	8.9	"	"	48	29.8	286.6
"	"	14	3.7	10.4	"	"	49	30.4	298.8
25 g.	1.03 lbs.	15	4.5	13.5	"	"	50	31.0	309.9
"	"	16	4.7	15.1	"	"	51	31.6	322.5
"	"	17	5.0	17.0	"	"	52	32.2	335.1
"	"	18	5.3	19.1	"	"	53	33.0	349.7
"	"	19	5.6	21.4	"	"	54	33.6	363.4
"	"	20	6.0	23.9	"	"	55	34.4	377.2
24 g.	1.16 lbs.	21	7.0	29.6	"	"	56	34.9	390.7
"	"	22	7.3	32.3	"	"	57	35.6	405.1
"	"	23	7.7	35.6	"	"	58	36.1	418.8
"	"	24	8.0	38.6	"	"	59	36.7	433.1
"	"	25	8.3	41.7	"	"	60	37.4	448.6
"	"	26	8.7	45.1	16 g.	2.66 lbs.	61	46.7	569.7
22 g.	1.41 lbs.	27	10.9	59.1	"	"	62	47.5	589.0
"	"	28	11.4	64.2	"	"	63	48.3	608.6
"	"	29	11.8	68.6	"	"	64	49.1	628.5
"	"	30	12.2	73.4	"	"	65	49.8	647.4
"	"	31	12.6	78.3	"	"	66	50.5	666.6
"	"	32	13.0	83.4	"	"	67	51.3	687.4
"	"	33	13.5	88.9	"	"	68	52.1	708.6
"	"	34	13.9	94.3	"	"	69	52.8	728.6
"	"	35	14.3	99.9	"	"	70	53.6	750.4
20 g.	1.66 lbs.	36	17.2	124.4	"	"	71	54.3	771.0
"	"	37	17.8	131.4	"	"	72	55.1	793.4

In this table the weights include rivets, solder and due allowance for trimming and laps; the elbows have an internal radius equal to the diameter of the pipe. Rectangular pipes are usually made of same gauge as round pipes of equal area.

B. F. Sturtevant Co.

FACTORS FOR REDUCING WEIGHT OF G. I. PIPE OF ANY GIVEN GAUGE TO THAT OF ANY OTHER GAUGE.

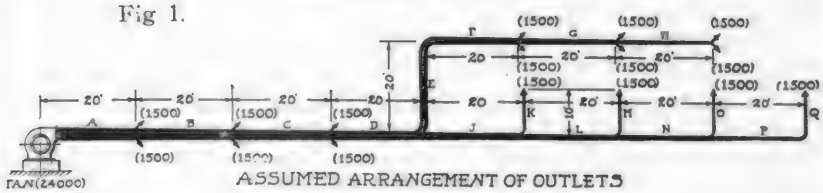
Given Gauge	OTHER GAUGES AND WEIGHT IN POUNDS PER SQUARE FOOT																			
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	4.53	3.91	3.28	2.97	2.66	2.41	2.16	1.90	1.66	1.53	1.41	1.28	1.16	1.03	.91	.84	.78
12	1.00	.86	.72	.66	.59	.53	.48	.42	.37	.34	.31	.28	.26	.23	.20	.19	.17
13	1.16	1.00	.84	.76	.68	.62	.55	.49	.43	.39	.36	.33	.30	.26	.23	.22	.20
14	1.38	1.19	1.00	.91	.81	.74	.66	.58	.51	.47	.43	.39	.35	.32	.28	.26	.24
15	1.53	1.32	1.10	1.00	.90	.81	.73	.64	.56	.52	.48	.43	.39	.35	.31	.28	.27
16	1.70	1.47	1.23	1.11	1.00	.91	.81	.71	.62	.58	.53	.48	.44	.39	.34	.32	.29
17	1.88	1.62	1.36	1.23	1.10	1.00	.90	.79	.69	.63	.59	.53	.48	.43	.38	.35	.32
18	2.10	1.81	1.52	1.38	1.23	1.12	1.00	.88	.77	.71	.65	.59	.54	.48	.42	.39	.36
19	2.38	2.06	1.73	1.56	1.40	1.27	1.14	1.00	.87	.81	.74	.67	.61	.54	.48	.44	.41
20	2.72	2.36	1.98	1.79	1.60	1.45	1.30	1.16	1.00	.92	.85	.77	.70	.62	.55	.51	.47
21	2.96	2.56	2.14	1.94	1.74	1.57	1.41	1.24	1.09	1.00	.92	.84	.76	.67	.59	.55	.51
22	3.21	2.77	2.32	2.10	1.89	1.71	1.53	1.35	1.18	1.08	1.00	.91	.82	.73	.65	.60	.55
23	3.54	3.07	2.56	2.32	2.08	1.88	1.69	1.49	1.30	1.20	1 10	1.00	.91	.81	.71	.66	.61
24	3.90	3.37	2.82	2.56	2.29	2.08	1.86	1.61	1.43	1.32	1.22	1.10	1.00	.89	.78	.72	.67
25	4.40	3.79	3.18	2.88	2.58	2.34	2.10	1.86	1.61	1.49	1.37	1.24	1.12	1.00	.88	.82	.76
26	4.98	4.30	3.60	3.26	2.92	2.65	2.37	2.10	1.82	1.68	1.55	1.41	1.27	1.13	1.00	.92	.86
27	5.40	4.66	3.90	3.54	3.17	2.87	2.57	2.28	1.96	1.82	1.68	1.52	1.38	1.23	1.08	1.00	.93
28	5.81	5.01	4.20	3.80	3.41	3.09	2.77	2.45	2.13	1.96	1.81	1.64	1.49	1.32	1.17	1.08	1.00

Example: To find weight of 28-in. pipe of No. 16 gauge. On data sheet No. 10-K, 28-in. pipe of No. 22 gauge weighs 11.4 lbs. Picking out the No. 22 gauge line in the above table and following across to the column marked "16 g." we find the correction factor 1.89 and 11.4x1.89=21.55 lbs., if made of No. 16 gauge metal.

B. F. Sturtevant Co.

SIZING OF DUCTS AND FLUES
METHOD NO. 1.

Fig 1.



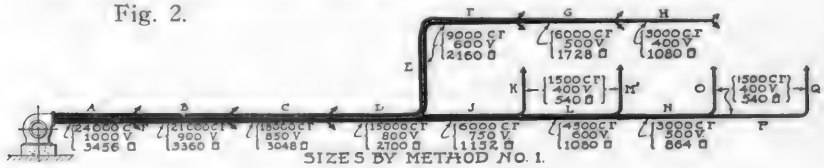
ASSUMED ARRANGEMENT OF OUTLETS

Fig. 1 involves supplying 1,500 cu. ft. of air to each of sixteen outlets, located as shown, from a fan placed at the left-hand end. It is assumed that these outlets are in different rooms but that air requirements are the same or, if the air is used for heating, that the heat requirements are identical.

Assume velocities in the ducts ranging from 1,000 ft. per minute at the fan down to 500 ft. per minute in mains P and H. Size the ducts on the basis of the area required to pass the given quantity of air at the given velocity. Size flues on the basis of 400 ft. per minute velocity; size the registers on the basis of 250 ft. per minute velocity through the free area.

This gives a schedule of sizes as shown in the following table:

Fig. 2.



SIZES BY METHOD NO. 1.

SOLUTION OF PROBLEM SHOWN IN FIG. 1, ACCORDING TO METHOD USED BY WRITER.

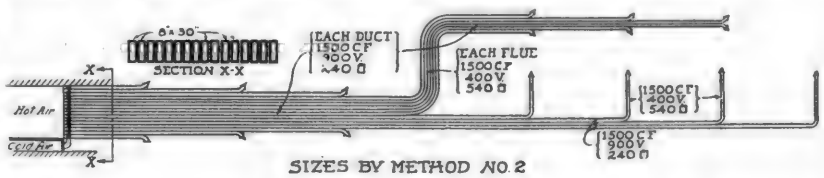
Duct or Flue	Length	Cubic Feet per Min.	Velocity Ft. Per. Min.	Area Sq. In.
A	Immaterial	24,000	1,000	3456
B	"	21,000	900	3360
C	"	18,000	850	3048
D	"	15,000	800	2700
E	"	9,000	600	2160
F	"	9,000	600	2160
G	"	6,000	500	1728
H	"	3,000	400	1080
J	"	6,000	750	1152
K	"	1,500	400	540
L	"	4,500	600	1080
M	"	1,500	400	540
N	"	3,000	500	864
O	"	1,500	400	540
P	"	1,500	400	540
Q	"	1,500	400	540

Registers equal 1500/250, or 6 sq. ft. net. This method is short, simple and in practice gives good results, the areas being as shown in Fig. 2.

SIZING DUCTS AND FLUES

METHOD NO. 2.

NOTE—In THE HEATING AND VENTILATING MAGAZINE for October, 1916, in an article by Harold L. Alt, various methods of sizing ducts and flues were outlined and examples shown. These comprise in all six different schemes of which one of each is illustrated and briefly outlined in Standard Data Sheets Nos. 10-M, 10-N, 10-O, 10-P, 10-Q, 10-R and 10-S. The example assumed for comparison is shown in Data Sheet No. 10-M (Fig. 1) and the reader is referred to the article in question for a more complete discussion of the subject.



SIZES BY METHOD NO. 2

Another method is not to use a trunk line at all unless all the outlets are in the same room. Where different rooms are supplied with air, different temperature requirements are encountered and this is taken care of by an individual duct system. In this system a single, separate duct is carried to each room (in this case, each outlet) and the air is supplied at the warmer or cooler temperature required. Automatic control operates mixing dampers in the hot and cold air chambers so as to give the desired temperature.

This method is illustrated diagrammatically herewith, the velocity in the flues being 400 ft. per minute and in the ducts being 850 to 900 ft. per minute; the ducts are made 8 in. wide by the depth required to give this velocity.

1500/850=1.76 sq. ft. x 144 = 253.44 sq. in. and this divided by 8 = 31+in. depth, 30 in. is usually adopted.

Velocity through registers, 300 ft. per minute through free area. This gives a schedule of ducts and flues as shown in the following table:

DUCT AND FLUE SIZES AS FIGURED BY METHOD NO. 2.

Ducts and Fues.	Length.	Cu. Ft. Per Min.	Velocity Ft. Per Min.	Area Sq. In.
All Ducts	Immaterial	1500	900	240
All Flues	Immaterial	1500	400	540

Registers 1500/300=5 sq. ft. net.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

May 14, 1918.—Fourth annual convention of the American Association of Engineers, in Chicago, Ill.

June 26-28, 1918.—Summer meeting of The American Society of Heating and Ventilating Engineers, in Buffalo, N. Y.

Miscellaneous Notes.

Shreveport, La.—The City Board of Health has adopted a resolution requiring the picture shows and those in charge of schools, churches and other places where there are gatherings, to "freely" ventilate their places. The resolution in full is as follows: "Resolved, that moving-picture shows, churches and schools be instructed to give their places of gathering the freest possible ventilation to minimize the danger of the spread of meningitis; be it further resolved, that on the failure to comply with these regulations, the Board of Health will prohibit all such gatherings." The city has recently passed through a meningitis epidemic.

Chicago, Ill.—Children of the Haines Practice School will be the subjects of a series of experiments to determine what sort of ventilation and temperature in school rooms will bring the best results. The board of education and the Chicago Commission on Ventilation will co-operate in the work. There will be open window rooms with normal temperatures, open window rooms with low temperatures, rooms ventilated by circulated air, with normal and with low temperatures, and rooms with the regular mechanical ventilation. For the open window rooms special clothing will be furnished by the Elizabeth McCormick Memorial fund. The value of food and rest will be taken into account, also. Psychological, medical, and scholarship tests will be made to determine which form of ventilation brings the best results for health and for academic efficiency. The experiments will last until the close of the school year. Dr. Sadie Bay Adair of the school board and Dr. Frank Bruner, director of special education, will represent the board in the work.

Chicago, Ill.—Moving-picture lessons on getting the most heat out of the least amount of coal are to be given in all picture theatres in Chicago shortly, in accordance with an arrangement made by the conservation department of the State Council of Defense and the theatre owners. Experts from the University of Wisconsin have prepared the necessary slides.

Grand Rapids, Mich.—At the annual meeting of the Grand Rapids Heating Contractors' Association, held recently, the following officers were elected: President, Everet Stadt; secretary-treasurer, T. S. MacLennan.

Building Industries of New York, which is a new organization made up of practically all of the building employers' associations in that city, has elected the following officers: President, Hugh Getty, president of the Building Trades Employers' Association; vice-presidents: Ernest R. Ackerman, president of the Lawrence Cement Co., Laurence McGuire, president of the United States Realty & Improvement Co. and president of the Real Estate Board of New York, and Franklin T. Miller, president of the F. W. Dodge Co.; treasurer, G. Osgood Andrews, representative of the Plate Glass Manufacturers of America; secretary, Allen E. Beals, of the Allen E. Beals Corporation. The new organization is intended to co-ordinate the building industry in New York City. Movements towards the establishment of similar organizations are proceeding in several other districts, notably in the Middle West, including Chicago, St. Louis, Kansas City, Omaha and Cincinnati. A detailed survey will be made in each district with a view promoting construction work.

Chicago, Ill.—A report which takes up, among other things, the ventilation of Chicago's street cars, has been made by City Chemist E. Vernon Hill. In this report it is stated that the new street-car ventilating and heating stoves, "introduced evidently as a matter of economy in the use of electricity," have not been found of much use. "Tests made," says Dr. Hill, "do not show good ventilation, even when the number of passengers is relatively

small, and they show so little temperature in cold days that they are not of much use. The machines are under the control of the conductor, and many cars have been noted in which, on cold days, the fans were not running, the motorman and conductor getting the benefit of what little air was warmed."

Albany, N. Y.—A bill introduced in the legislature by Assemblyman Orr would make failure on the part of the owner of an apartment house to furnish heat and plenty of hot water from October to May a misdemeanor, punishable by ten days' imprisonment, or a fine of $200. The measure calls for an even temperature of 68° F. from October 1 to May 1.

American Gas Institute and the National Commercial Gas Association are completing plans for the amalgamation of the two organizations. It was expected that the final draft of the constitution and by-laws and plan of procedure would be submitted to the membership of the two organizations some time in March.

American Institute of Chemical Engineers will hold its summer meeting in Berlin, N. H., June 19-22. Headquarters will be at the Madison House, Gorham, N. H.

Ottawa, Can.—The operation of all manufacturing plants in Canada, with the exception of Western Canada and the maritime provinces, was suspended February 9, 10 and 11 in order to conserve fuel. The order followed closely along the lines of the American five-day closing order and granted virtually the same exemptions. It was also ordered that theatres and other places of amusement should remain closed every Monday from February 18 to March 25. The shutdown order was passed by the cabinet upon the recommendation of C. A. Magrath, the Dominion Fuel Controller.

Waddill Catchings, who recently joined the banking firm of Goldman, Sachs & Co., New York, has been elected a director of the Studebaker Corporation, of South Bend, Ind.

American Society of Sanitary Engineering will hold its annual meeting in Chicago, September 3-5, 1918. Headquarters will be at the Congress Hotel.

TRADE METAPHRAM MARK
REG. U.S. PAT. OFFICE

Steam Damper Regulators

THE COMPLETE LINE WITH ALL THE REFINEMENTS

Type A— 4" for Low Pressure
Type B-C—7" for Low Pressure
Type D— 10" for Vapor
Type F— 2" for Hot Water

All Metal—Sensitive—Slidable Levers, Adjustable Fulcrum—All Parts Renewable.

Send for Prices and Circular

NATIONAL REGULATOR CO.
FACTORY AND GENERAL OFFICES
208-212 South Jefferson Street
CHICAGO

"A-JACKS" for High Pressure

Direct Connected. Graduated Action.

DETROIT PACKLESS RADIATOR VALVES

The Correct Valve for the Beautiful Home

Detroit Packless Valves are finished with the definite purpose, that they shall harmonize with the most beautiful surroundings. In addition to their unusually pleasing appearance and smooth satin finish they are permanently efficient and will not leak or need repacking.

Booklet VP-1 Gladly Sent Upon Request

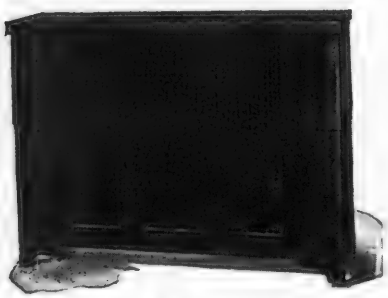
DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

National Planning Bureau, with headquarters in Wilkes-Barre, Pa., is starting an advertising campaign of national scope in the interests of the building trades, manufacturers of building materials, and architects and engineers. The slogan of the organization is "Plan Buildings Now," so that when peace comes the trade will be ready to take advantage of the building boom that is expected to follow. The point is made that it takes time, care, thought, experience and skilled men to plan buildings and that attention to these matters now will prevent the construction of commercial or architectural monstrosities immediately after the war ends. Edmund H. Poggi, architect, is the manager of the National Planning Bureau.

Building Permits for January, 1918, as compiled by the *American Contractor,* Chicago, for 111 principal cities in the United States, came to $26,889,082, as compared with $49,809,486, for January, 1917, or a decrease of 46%. Twenty-five cities, however, showed an increase, including Buffalo 53%, Cincinnati 28%, Denver 44%, Des Moines 25%, Grand Rapids 51%, Kansas City 60%, Los Angeles 625%, Minneapolis 11%, New Haven 526%, Oklahoma City, Omaha 40%, Seattle 39%, Tacoma 148%. Cities showing losses included Akron 68%, Atlanta 74%, Baltimore 72%, Boston 80%, Cleveland 69%, Dallas 37%, Dayton 61%, Detroit 50%, Hartford 81%, Kansas City 71%, Milwaukee 21%, Newark 56%, New York 48%, (Borough of Manhattan showed a loss of 63%), Oakland 54%, Philadelphia 21%, Pittsburgh 57%, Portland, Ore., 53%; Richmond 88%, Rochester 75%, San Francisco 64%, St. Louis 88%, Toledo 94%, Washington 84%, Wichita 29%, and Wilmington 83%.

Building permits for February, 1918, omitting, of course, the vast government construction activities totaled $29,074,332 as compared with $52,739,254 for February, 1917. These figures are reported by the *American Contractor,* Chicago, and cover 110 principal cities in the United States. The decrease amounts to 44%. The few important cities showing gains were: Baltimore 114%, Duluth 20%, Harrisburg 1569% ($181,900 as compared with $10,895), New Haven 409%, Borough of the Bronx, New York, 12%; Oakland 11%, Oklahoma City 57%, Pittsburgh 71%, Portland, Ore., 5%; Seattle 40%; Sioux City 370% (including $400,000 department store), St. Paul 9%, Tacoma 154%, Wichita 12%, and Youngstown 167%.



The Ja-Nar

(Sylphon Temperature Control)

This simple method of temperature regulation covers the radiator with a well-designed cabinet finished to match mahogany, oak, walnut or enamel, to correspond with its surroundings.

It operates automatically on the well-known Sylphon principle of thermostatic control and requires no pipes, wires or connections of any kind. Just place it over the radiator. Each Ja-Nar operates independently. **Send for Catalogue "H".**

A really satisfactory Air Valve

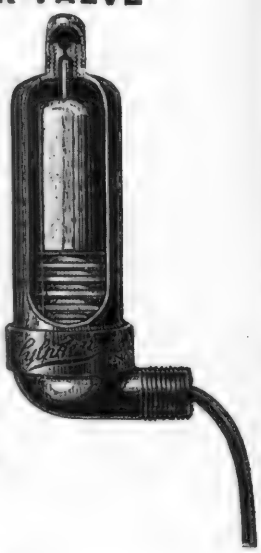
The Sylphon AIR VALVE

Needs no Adjustment.

Thermostatic Operation.

Absolutely Guaranteed.

Positive in Action, Durable, Fool-proof.



If you cannot obtain it from your jobber write us, giving his name.

THE FULTON COMPANY, Knoxville, Tenn.

New York Office: 141 Broadway

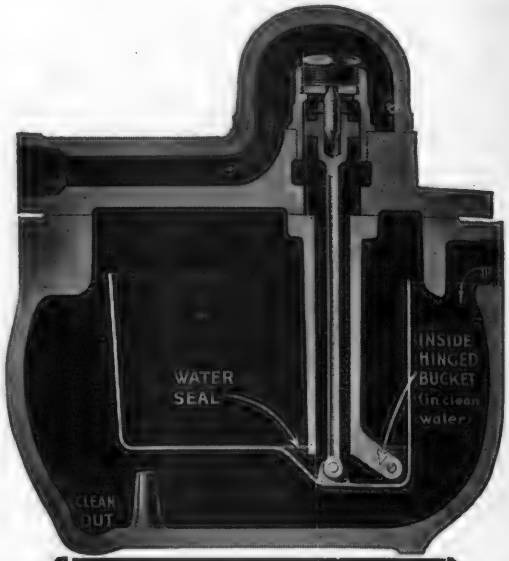
Sturdy as the Eternal Mountains
Accurate as a watch wheel
Sturtevant
(REG.U.S.PAT.OFF.)
APPARATUS
"BUILDING to an ideal" may be a trite way of expressing the Sturtevant creed, but that is exactly the motive that inspires the men who are responsible for the Sturtevant reputation. On the land, on the sea, in the air, wherever Sturtevant apparatus is used, the man who uses it may feel certain that if it were possible to make a better piece of equipment, its name would still be Sturtevant.
Ruggedness, accuracy and reliability—these virtues are ingrained into every inch of Sturtevant Apparatus—and it is these virtues that are responsible for the ever-increasing use of Sturtevant Apparatus in the United States Navy, because the ideal dominating its makers is transmitted into the furthermost corners of our huge factory so that the most minute cog in the great Sturtevant machine may know that nothing short of absolute perfection will pass muster.
Catalogs on Sturtevant Fans and Prime Movers are yours for the asking
B. F STURTEVANT COMPANY
Dept. B., HYDE PARK, BOSTON, Massachuetts.
Fans Heaters Air Washers Motors Engines

Don't Put Off Till Tomorrow the Bond That You Can Buy Today

For Full Information
Address
SPECIAL LIBERTY LOAN COMMITTEE
Machinery and Machine Tool Trade—334 Fourth Avenue, New York

Eastern Supply Association held its winter meeting at the Hotel Astor, New York, Feb. 13. Among the new members elected was the American Radiator Company. The principal address of the meeting was delivered by former Senator Theodore E. Burton, who spoke on "The Awakening of America." A rousing address on "The Apostle of Sunshine," was given by Edward James Cattell. Captain A. M. Maddock urged that steps be taken in the heating and plumbing industry to overcome the present depression in the building trade. He urged the trade to take up more actively the refitting of existing buildings and that a campaign with this end in view be undertaken by the National Association of Master Plumbers as well as by manufacturers and jobbers. It was voted to arrange for a joint meeting between the National Committee of Confederated Supply Associations and representatives of the master plumbers' associations to further this movement.

Central Supply Association held its 76th regular meeting in Chicago, February 21, at the Auditorium Hotel. A tentative uniform cost accounting plan was presented by a committee consisting of E. I. Leighton, E. Buehler and C. V. Kellogg. This was in the form of an expense distribution sheet and was made out in percentages. The principal items were listed as (1) selling expenses, (2) salaries, (3) rent, (4) legal expense, (5) warehouse labor and expenses, (6) boxing, (7) cartage, (8) miscellaneous, (9) cash discounts allowed, (10) depreciation on buildings, if owned, (11) depreciation on fixtures and equipments, (12) bad debts, (13) interest on borrowed money, (14) interest on investment, (15) salaries to executive officers or partners, and (16) incoming freight to be charged to merchandise account. Another movement which received the endorsement of the convention was a joint conference between representatives of the manufacturers and jobbers and the national committee of the National Association of Master Plumbers, with the object of inaugurating a national campaign to call the attention of the public to the fact that the present was an opportune time for remodeling, renovating and repairing buildings, particularly private dwellings, in the line of heating and plumbing installations. After luncheon the convention was addressed by William F. Worcester on the subject of "Depreciation, Co-Insurance, Appraisal and Tax Reports."



Catching Dollars with a Trap

THE SWARTWOUT

Hydromatic **Trap**

TRADE MARK

will catch and save for you the dollars that would otherwise go to waste.

When coal is high-priced and hard to get at any price, the little, over-looked wastes of our former "easy-going" days must be stopped.

The Swartwout Hydromatic Trap will positively prevent any waste of steam at your heaters or steam lines. Its action is certain—effectual. It prevents that wasteful drizzle that is constantly nibbling at your coal pile.

Swartwout Hydromatic Traps will pay big dividends—in many cases they have paid for themselves in one month.

Write today and find out how they will help you to conserve coal. Full information and catalog—free.

The Ohio Blower Co.

9211 Detroit Ave. Cleveland, Ohio.

Westinghouse

Motors and Control

Postal Life Building's Compact Fan Installation

Westinghouse Ventilating Equipment

This installation of a 20 horsepower Westinghouse Motor mounted between and directly connected to, two Sturtevant Fans, is a very compact and successful job.

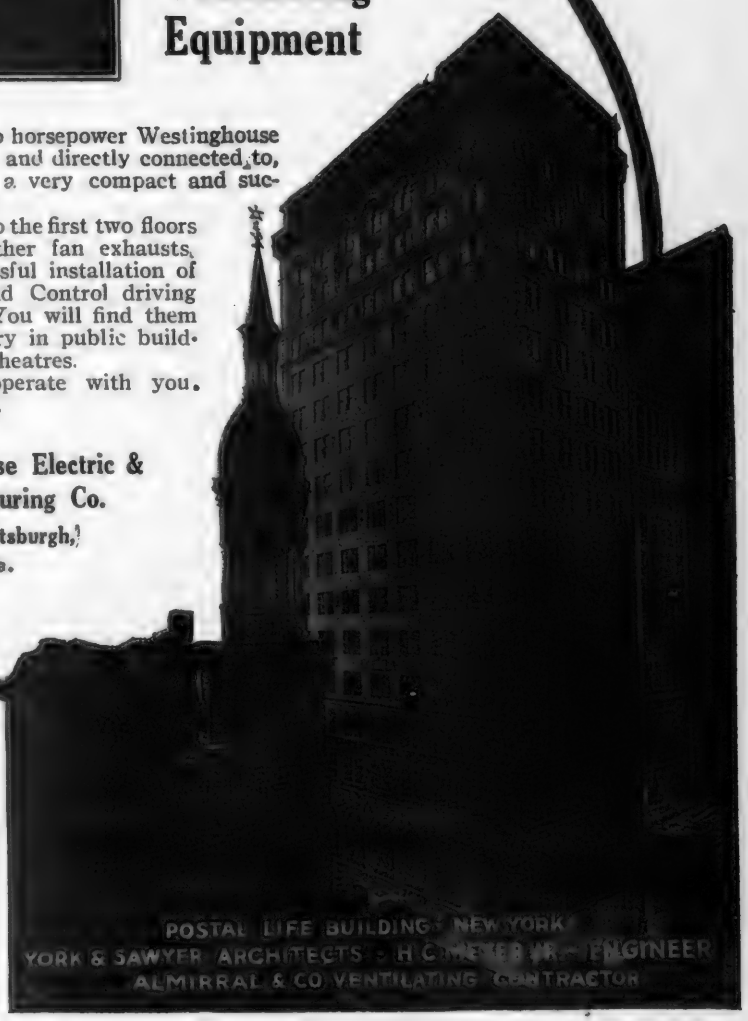
One fan supplies fresh air to the first two floors of the building. The other fan exhausts. This is but another successful installation of Westinghouse Motors and Control driving ventilating equipment. You will find them in all parts of the country in public buildings, schools, clubs and theatres.

Our engineers will cooperate with you. Write for Booklet 7193.

Westinghouse Electric & Manufacturing Co.

East Pittsburgh, Pa.

837



W
WESTINGHOUSE ELECTRIC

Central Station Heating Notes.

Springfield, Ill.—Thirteen companies of the McKinley traction system are seeking increases in rates affecting electric and gas service, steam and hot water heating service and street car fares. Hearings are being held before the Public Utility Commission at Springfield.

Indianapolis, Ind.—Increases of rates for the Sheridan Water, Light & Heat Company have been authorized by the Indiana Public Service Commission. The Indiana Railways & Light Company, of Kokomo, has petitioned for permission to discontinue free heat service to the Kokomo city building, and the Interstate Public Service Company has petitioned for cancellation of free gas, water and electric service to the city of Shelbyville.

Adrian, Mich.—Much interest attaches to a suit which was tried in the circuit court in which the city of Adrian sought to compel the Citizens' Light & Power Company to reduce its rates for steam heat. It was claimed by the city that under the company's franchise it cannot maintain its present charges for steam heat. A bill of complaint was filed by the city the first part of December asking the court to enjoin the company from charging the new rate for steam heat and asking the company to set aside amounts paid in by patrons and to return excess charges to patrons if they were beaten in this suit. The decision of the court is being awaited.

Brooklyn, N. Y.—Under the heading of "Factory Steam to Heat Homes?" the *Brooklyn (N. Y.) Eagle* publishes an item that is significant of the trend of thought towards central station heating service as a result of the past winter's fuel shortage. The item reads as follows:

"The coal famine has brought forward many suggestions as to how the recurrence of such a calamity might be averted. One of these suggestions is the more general employment of central heating plants. Theoretically the economy of a central heating plant should be as great as that of a general power plant. Practically it is. Wherever put into operation it has worked admirably. A building company has found such a plant for the neighborhood of Emerson place and Willoughy avenue an excellent investment.

"The suggestion has been made that

Tycos

TEMPERATURE INSTRUMENTS

In describing *Tycos* temperature instruments we make no attempt to put a crimp in advertising's vocabulary. Behind them is a solid structure of manufacturing experience, the result is a product giving results as nearly complete as correct construction, tried by practical experience can give—full measure of service.

Surely producing more temperature instruments than any other concern on earth is evidence of our ability to serve a large and discriminating demand for a product of solid worth at all times and at a *right* price.

Let us have your address for folder "On the Trail of the Thermometer" and other literature.

Tycos Mercurial, Recording and Index Thermometers for all industrial and laboratory applications.
Electric Contact Thermometers.
Temperature, Pressure and Time Regulators.
Mercury Column Vacuum, Pressure and U Gauges.
Tycos Base Metal, Rare Metal and Radiation Pyrometers, (Indicating and Recording) Fery Radiation Pyrometers.
Hygrometers
Hydrometers.
Mineral Oil Testing Instruments.
Aneroid and Mercurial Barometers.
Recording Barometers.
Pocket Compasses.
Surveying Compasses.
Rain Gauges.
Anemometers and Air Meters.
Thermographs.
Hand Levels.
Aviation Barometers.
Inclinometers.
Tycos Sphygmomanometers.
Tycos Fever Thermometers and Urinary Glassware.
Thermometers of all kinds for home and general use.

Taylor Instrument Companies

Rochester, N. Y.

No. 40

neglected sources of heat in factories now being allowed to dissipate their energy be utilized. A great majority of Brooklyn factories supply their own power, which is steam. The exhaust steam is employed in heating their buildings. In practically no instance, it is claimed, is this exhaust steam utilized to its utmost. Much of it is allowed to escape. The suggestion is to use this excess exhaust steam heating neighboring dwellings.

"After the dwellings have been connected it is only necessary to maintain circulation, which can readily and cheaply be maintained through the vacuum system employed for so many years by Pratt Institute, the real pioneers in the use of the vacuum system. In this system the steam has all but lost its expansive power. However, it is still capable of radiating heat. By means of the vacuum pump the steam is drawn slowly through the circuit of pipes and the condensed water returned to the boilers.

"It is a well-known fact that the private, individual heater requires a high-grade of coal. The large boilers of the power plants, on the other hand, are capable of using the very cheapest grades. Some of the rice coal burned in factory boilers is hardly more than 50% coal. The heat is so intense, however, that the cheap grade of coal is easily consumed.

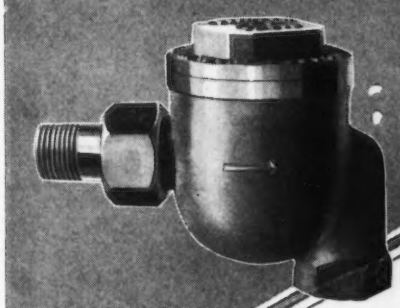
"Another advantage pointed out in the central heating plant is that the large plants are heavy and consistent consumers of coal and, therefore, receive prior consideration from the dealers."

Anderson, Ind.—As the result of a petition filed by the Central Heating Company, of Anderson, asking that it be permitted to retire from business because it was operating at a loss, an arrangement has been made whereby the plant will be operated on a new basis by a co-partnership consisting of B. W. Bissell, of Indianapolis; George H. Alexander, of Logansport; and A. J. Stahl, of La Porte. Under the terms of this agreement, which was reached after several conferences between the representatives of the company and the consumers, and which has been approved by the Public Service Commission of Indiana, the plant of the Central Heating Company will be operated on the basis of the present schedule of rates, but the bills will be rendered for the service from this date (March 9) to April 15, 1918, on the basis of cost, if such cost exceeds the present published rates, but in no event is the cost to exceed $1.25 per 1000 lbs. prima facie rate and a like percentage on the lower rates. The public service commission is to have its auditors

A short cut to a fair profit

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

Johns-Manville Radiator Trap



Keep a dozen Johns-Manville Radait Traps right in the bin—in the store-room—where your job-runners can pick them up quick on call. It's a good way to reach your men, the economy and advantages of the trap and it's an easy way to assure yourself your rightful profit on the next big job that comes along.

For while it's easy to figure the number of traps you'll need and the time to attach them, it's another matter to guess the time it may take to make adjustments.

And it's the cost of that time that eats up your profit on the job. Simplicity of construction makes adjustments in the Johns-Manville Radiator Trap unnecessary. For there are but three parts—the body, connecting union and rolling ball.

We will be glad to send our bulletin with its suggestions to you if you'll ask it.

H. W. JOHNS-MANVILLE CO.
NEW YORK CITY
10 Factories—Branches in 61 Large Cities

audit the books of the company before bills are rendered, and the public service company is to declare, before the rendering of the April bills, the rate for such service with the limitations already mentioned. The agreement is limited to April 15, 1918. The commission was told that the owners of the plant had lost about $50,000. The three men who have taken it over have assumed the bonded indebtedness of $60,000. It is understood that the property represents an investment of $150,000.

Manufacturers' Notes.

New York Continental Jewel Filtration Co., announces the removal of its offices to its newly-acquired factory in Nutley, N. J. (Newark district).

Kewanee Boiler Co., Kewanee, Ill., announces that a shipment was made by the company on March 1 of 21 carloads of boilers for the United States Army in France. This makes a total of 13,502 boilers that the company has furnished the army and navy since May 1 of last year.

Clarage Fan Co., Kalamazoo, Mich., announces the appointment of H. P. Curtiss as the company's representative for the New England States. Mr. Curtiss was formerly representative of the American Blower Company, of Detroit. His headquarters will be at 120 Milk Street, Boston.

H. W. Johns-Manville Co., New York, announces the removal of its St. Louis branch to its new building at Olive and Eleventh Streets. The new quarters occupy the entire six stories of the building which is of modern fire-proof construction throughout. Wherever practicable Johns-Manville products were used in the finishing of the building, including mastic floors, asbestos wood partitions and asbestos roof.

Battermaan Truitt Co., Chicago, Ill., manufacturers of the Batterman line of motor fans and dealers in ventilating, heating and drying apparatus, has opened a district sales office in Cleveland, O. L. H. Green has been appointed manager of the Cleveland branch.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has leased, for a period of years, the Baxter Stove Company, at Mansfield, O., with the intention of consolidating at this plant the manufacture

THE NEW JOHNS-MANVILLE BUILDING
11TH AND OLIVE STS., ST. LOUIS, MO.

Fourteen 600-H. P. Machines
One Shipment

Draining heated apparatus and feeding the condensate directly into boilers at temperatures over 300° in some instances

Send for our catalogue showing 12 types of machines and 25 system designs

FARNSWORTH CO.
Conshocken, Pa.

of its heating appliances now being carried on at some of the other Westinghouse plants. The company's office in Phoenix, Arizona, has been removed to Tucson, Arizona, where quarters have been secured in the Immigration Building. J. H. Knost and W. G. Willson are the company's representatives at this point.

Atlantic Radiator Co., Huntingdon, Pa., reports the most prosperous year in its history. The officers elected for the ensuing year are: President, R. C. Schwoerer; vice-president and secretary, H. T. Gates. Mr. Gates was also appointed general manager, and Alfred W. Smith, assistant general manager. The company has recently enlarged the core-room at its plant, which will treble the plant's capacity. J. P. Coughlin has been appointed auditor of the company.

J. H. McLain Co., Canton, O., manufacturers of heating boilers and radiators, has come under the control of Chicago interests through the sale of the interests of J. E. McLain, president of the company. It is stated that the retirement of Mr. McLain is the only change made in the direction of the company, P. L. McLain remaining as vice-president and treasurer, and H. A. Staley, as secretary.

American Pressweld Radiator Corporation, Detroit, Mich., announces the appointment of Edward J. Lomasney as manager of the company's Chicago office at 223 East Erie Street. Mr. Lomasney was formerly Detroit manager for the Spencer Heater Company. W. C. Winsborough has been appointed St. Louis manager, and his son, Paxson Winsborough, represents the company in Kansas City, with offices in the Lathrop Building. Following are the company's other representatives: J. F. Siegel, New York; F. A. LaClerq, Seattle; J. G. Roeller, Minne-

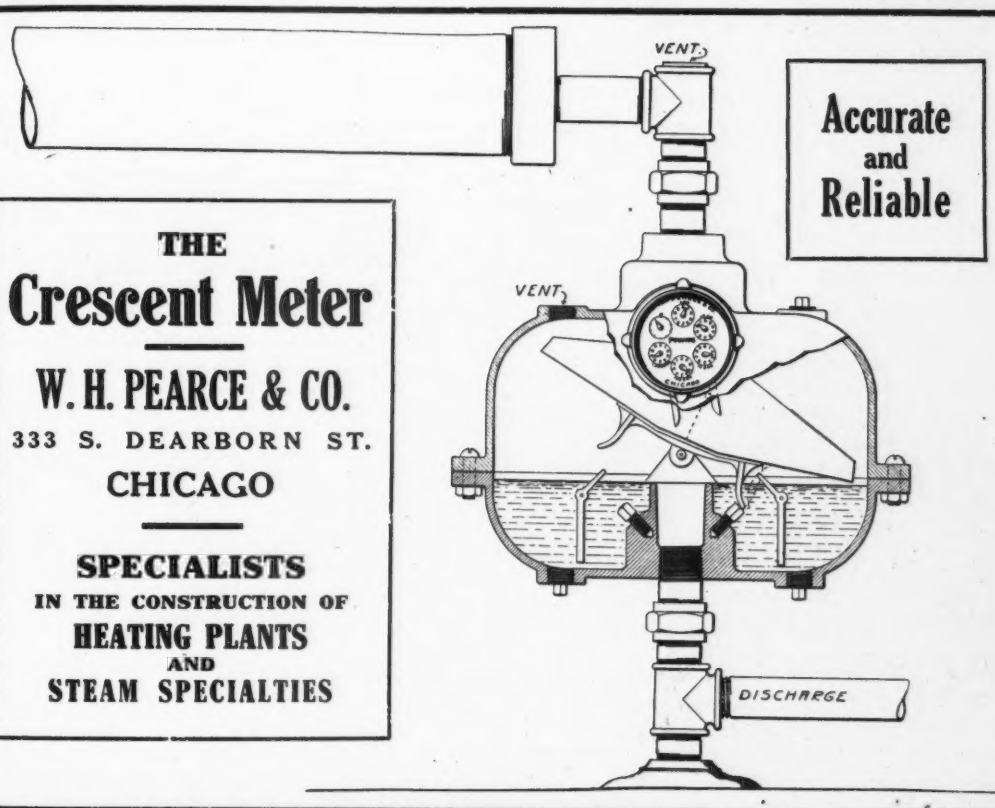
Braemer

Air Conditioning Corporation

Air Purifying—Air Cooling—Humidifying—Dehumidifying—Industrial Ventilation—High and Low Temperature Drying—Generator Coolers—Dust Removal—Reclamation.

Webster Air Washers

LAFAYETTE BLDG.
PHILADELPHIA



Accurate and Reliable

THE
Crescent Meter

W. H. PEARCE & CO.
333 S. DEARBORN ST.
CHICAGO

SPECIALISTS
IN THE CONSTRUCTION OF
HEATING PLANTS
AND
STEAM SPECIALTIES

apolis; E. H. Doherty, Salt Lake City; J. A. Sullivan, Buffalo; H. P. Cannon, Pittsburgh; George D. Findley, Atlanta; H. D. Phelps, Des Moines; F. T. Schriner, Detroit; Pattison Supply Co., Cleveland; Omaha Sanitary Supply Co., Omaha; and M. E. Danforth, Washington, D. C.

Mathis Bros. Co., Chicago, Ill., manufacturers of blowers and ventilating systems, with plants in Chicago and Bucyrus, O., has purchased the factory building and grounds occupied by the American Three-Way Prism Co., at La Porte, Ind., and will move its plant to La Porte in the near future.

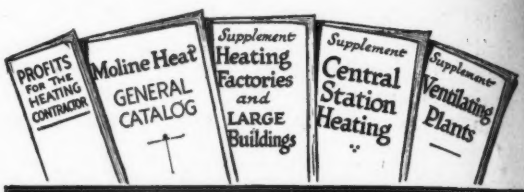
Ilg Electric Ventilating Co., Chicago, Ill., has completed the purchase of 12½ acres of the Lister estate, at Elston Avenue and Snow Street, at a price of $128,570. The new plant which will be constructed on the site will involve the expenditure of $600,000. Plans for the new factory are being prepared by Lebenbaum, Marx and Vigeant. It will be of the latest type of fireproof construction, four stories high and will be built in units of 300x60 ft. ground dimensions, connected by passageways and 80-ft. light courts. Much attention will be given to the comfort and health of employes, including rest-rooms, shower-baths, gymnasium, company dining and club room.

Stack Heater Co., Boston, Mass., has moved its factory from Worcester to Boston and quarters for both the factory and general sales offices have been secured near the North Station, containing 5,000 sq. ft. of floor space. Elmer S. Stack is president of the company.

Lytton-Rowe Mfg. Corporation, Norfolk, Va., recently organized in that city, has opened general offices and factory at 108-118 Scott Street. The new company will specialize in the manufacture of high and low-pressure direct return traps and pressure-reducing valves. President, J. W. Lytton; vice-president, P. D. Barco; secretary and treasurer, W. R. Boutwell.

Buffalo Forge Co., Buffalo, N. Y., has filed plans for a two-story addition to its plant at 493 Spring Street.

Warren Webster & Co., Camden, N. J., omitted the reunion this year of its engineers and sales force, but an informal conference was held by those present at the recent meeting of the American Society of Heating and Ventilating Engineers, in New York, in January. The delegation was



THESE VALUABLE BOOKS *FREE!*

Each one is worth big money to you. Every heating contractor should have them. They cover all the latest money-making ideas in figuring and installing steam heat—hot water heat—vapor heat—and vacuum systems.

These books will help you to land more orders and increase your profit on every job. Write for them at once. They are absolutely *FREE!*

Moline Illinois

STANDARD Steam Pipe Casing

For Insulating Underground Steam Pipe. Tin Lined, or Unlined.

Every salesman has his argument in order to sell the product he represents. Listen to our argument, be the judge, and you will find same not theoretical but practical, and from actual experience.

When you cover your steam line with our make of casing you have the assurance that the line will be constructed so that no heat will escape, and will be water tight as well, with ample space for air chamber.

Should occasion arise that it is necessary to get at the steam pipe, our covering CAN BE TAKEN APART WITHOUT DESTROYING THE STAVES in the sections of casing, and the same casing can be used again. LET US EXPLAIN HOW.

If your line runs in different branches we will build the casing in exact lengths so that you will not have to cut any sections, which means no waste or extra expense to you.

Our method of building covering will be to your interest. Our product is right, attention prompt, and prices low.

SEND FOR BOOKLET

Standard Wood Pipe Co.
WILLIAMSPORT, PA.